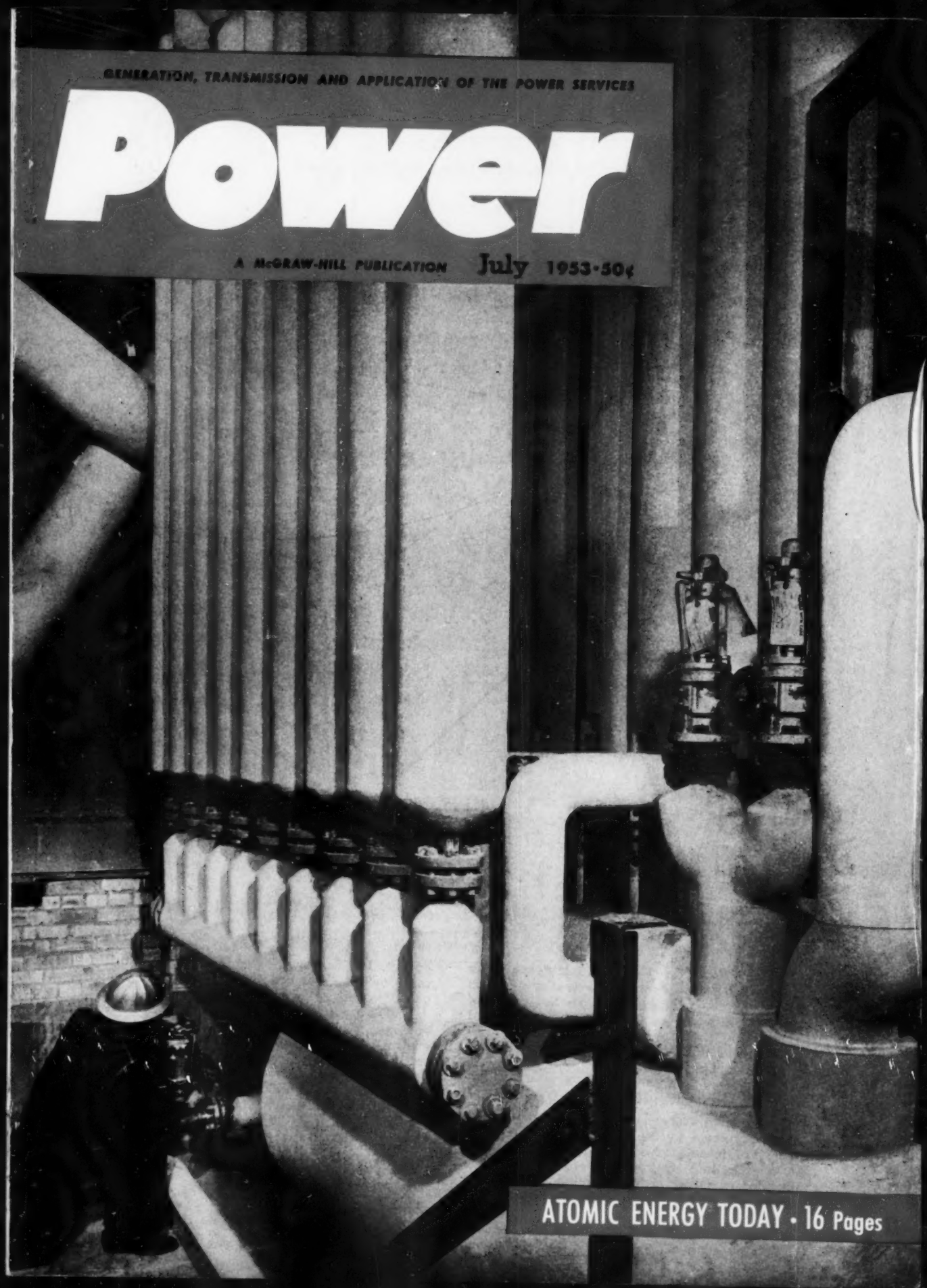
GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES
Power
A McGRAW-HILL PUBLICATION
July 1953·50¢
ATOMIC ENERGY TODAY · 16 Pages

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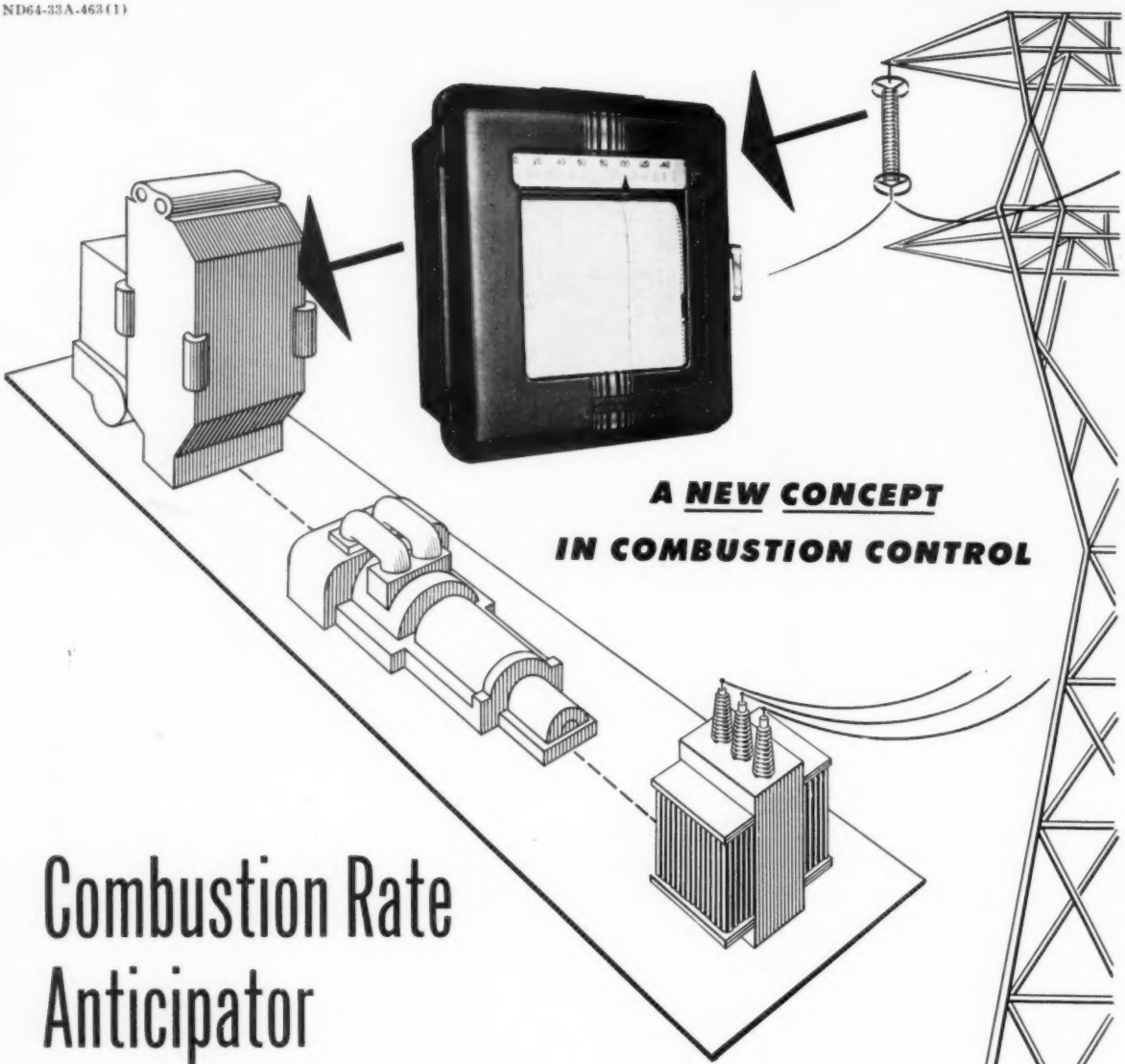


A NEW CONCEPT

IN COMBUSTION CONTROL

Combustion Rate Anticipator

for coordinated unit or system operation

Here's the "missing link" in automatic steam power plant control. It is a control system which adjusts combustion rate at the boiler the instant electrical demand changes . . . actually in advance of steam demand. Result: more uniform steam header pressure, less upset during load changes, more efficient unit and system operation.

How is this accomplished?

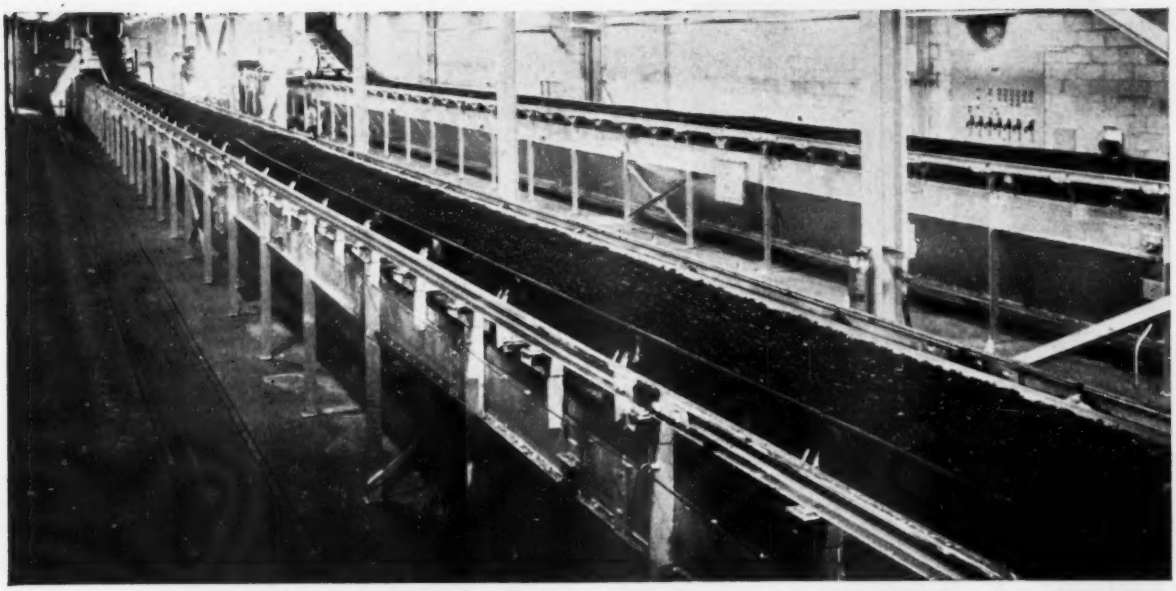
In all combustion systems, *ultimate* boiler combustion rate is determined by the *final* Kw demand. The Combustion Rate Anticipator, for the first time, provides *a direct link* by initiating changes in boiler combustion rate directly from regulation applied to the turbine governor, as well as the actual generator output. In this way, the Combustion Rate Anticipator provides closer coordinated control of a boiler and turbo-generator unit.

L&N's experience on both generator load control and combustion control has made this integrated control system possible. This dual experience stands ready to apply the Combustion Rate Anticipator to your plant for improved unit or system operation.

Leeds & Northrup Company, 4910 Stenton Avenue, Philadelphia 44, Pa.

LEEDS LN NORTHRUP

instruments automatic controls • furnaces



This power plant uses Link-Belt self-propelled trippers to discharge coal to bunkers from twin Link-Belt 36-in. wide belt conveyor systems, each handling 450 TPH.

TOTAL ENGINEERING

It's LINK-BELT's answer for improved belt conveyor performance

BELT conveyor efficiency begins with correct analysis of overall system requirements. And right from the start Link-Belt offers you unique advantages. Our engineers can apply broad experience to your bulk handling problems.

Working with a complete line of quality components, they can select the belt conveyor equipment best suited to your exact needs. What's more, Link-Belt has a nation-wide engineering organization that will follow through on every detail. This includes supplying all related equipment . . . building supporting structures and enclosures . . . erecting the complete job, if desired.

It's easy to see why "total engineering" results in top belt conveyor performance. For complete information, call the Link-Belt office near you today.

13,121-B

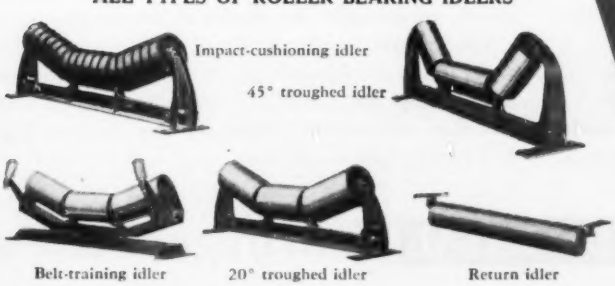
LINK-BELT

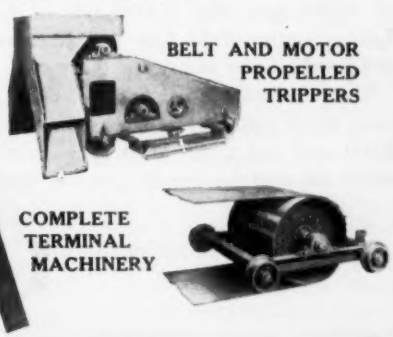
BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities.

LINK-BELT builds a complete line of belt conveyor components

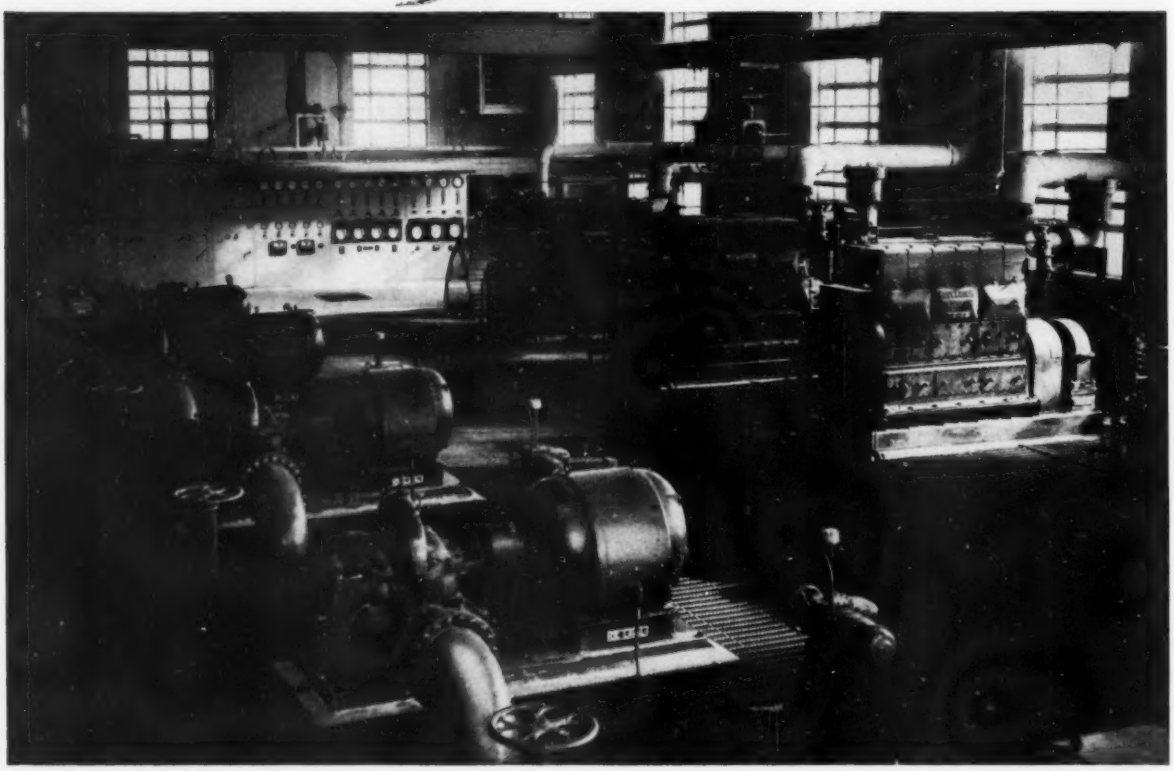
ALL TYPES OF ROLLER BEARING IDLERS





DE LAVAL
FIRE PUMPS

on the job at Idlewild



Ten De Laval centrifugal pumps, with a total capacity of 34,000 gpm, play a vital role in the deluge fire-fighting system of the New York International Airport at Idlewild, Long Island.

The installation is composed of two 2,500 gpm and three 4,000 gpm motor-driven pumps as well as two 2,500 gpm and three 4,000 gpm diesel-driven units, which are used for standby service. When the normal operating pressure drops from 165 psi to 140 psi or less, the electric pumps go to work automatically. The diesels are brought into service as necessary.

Efficient De Laval centrifugal pumps are serving water works and fire-fighting stations all over America. These pumps are available in capacities ranging from less than one million gallons per day to more than 100 million gallons per day.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY
815 Nottingham Way, Trenton 2, New Jersey

DL-179

Power

JULY 1953 • VOLUME 97 NUMBER 7

ENGINEERING AND MANAGEMENT

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POWER (with which are consolidated *Science and Industry, The Engineer Review, The Engineer, The Stationary Engineer* and *Operating Engineer*) is published monthly with an additional Handbook statistical number in September, by McGraw-Hill Publishing Company, Inc. James H McGraw (1860-1948), Founder.

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POWER articles are indexed in both the *Industrial Arts Index* and the *Engineering Index*. POWER publishes its own annual index, which is available for 50¢ from the editorial offices.

ATOMIC ENERGY brings a new look to the power business. You get the feel of it in proposals for large-scale plants, outlined in the report beginning on p 89. And you see it "in the flesh" in our cover photo.

This shows an experimental steam generator developed at Argonne National Laboratory for use with the experimental breeder reactor. Extracting heat from the reactor's liquid-metal coolant, it generates 400-psi steam, which is separately superheated to 550 F. In a turbine-generator, this steam develops 170 kw — capacity enough to meet power demands of the reactor and of its building.

Unlike familiar steam boilers in many ways, this unit, "fired" with molten metal, has one point in common with them—it needs good heat insulation. For modern methods of application, look at pp 73-78.

Next month . . .

■ What does it take to insure good welds on alloy-steel pipe for 2350 psi, 1100 F? For a fast and full answer, see a step-by-step picture story coming up.

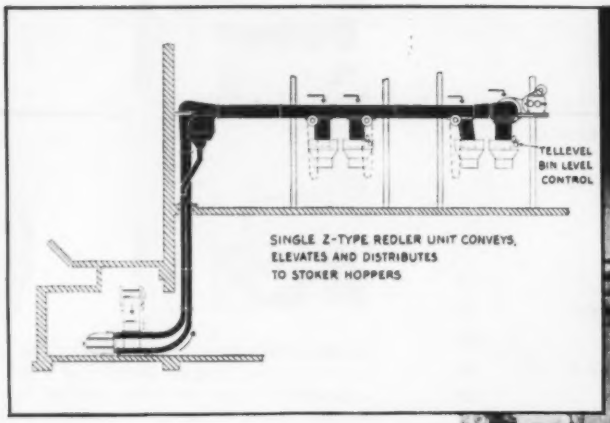
■ Boiler water gages get a "one-two" treatment next month. In the E&M Section you'll find a thorough discussion of types, selection and application. And "Operators' Notebook" brings you practical pointers on solving the pesky problem of glass breakage.

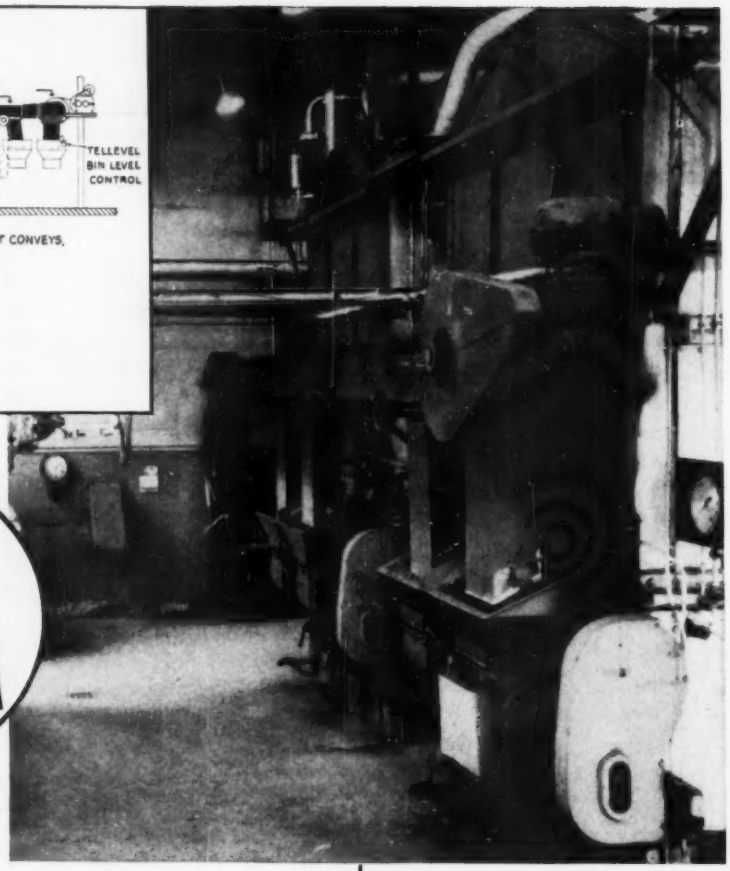
■ When a company like Western Electric embarks on a modernization program, they go all out. We're going all out, too, in working up an exciting presentation of what may well be the modernization story of the year. Watch for it in August.

. . . and future months

■ "Super-pressure" boiler, now announced officially (p 150, this issue), has been exciting engineering curiosity ever since the first rumors started drifting about. Right now, however, the kind of information you'd like to have and we'd like to print just isn't available. When it is, POWER will bring you the fullest possible story.

■ Reminder for planners: Extra *Modern Plant Handbook* issue comes in mid-September; special report on today's electrical practice in October.





S-A

CONVEYING *Systems* can give you "automatic" handling of coal —from storage to stoker

This S-A System uses a Redler conveyor to move coal from storage to stoker hoppers. It fills the hoppers as needed, *never* overflows them and *never* causes a dusty boiler room. It takes just one unit to do the whole job.

Whether you want high volume handling, dust-free delivery, selective distribution or any other bulk handling benefit, S-A engineers can give you a simple, direct solution to *your* coal handling problem. They work with a complete line of equipment, draw upon experience of over half a century. Write for a free survey now.

EASTERN STATE HOSPITAL
Knoxville, Tennessee

A single Z-type Redler moves 1½ inch coal from storage hopper to two boiler stoker hoppers. Coal is carried horizontally for 10 feet, then elevated vertically 15 feet and then travels for 32 feet over stoker hoppers. S-A Tellevel Bin Level Controls at discharge points prevent overflow at hoppers. The system handles 4¼ tons per hour, with a single unit serving where three would ordinarily be needed. Absence of dust and selective feeding are other benefits.

Belt Conveyors
REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Weigh Larries
Crushers, Roll & Ring Type
Bucket Elevators
Pivoted Bucket Carriers
Screw Conveyors
Skip Hoists
Belt, Pan & Plate Feeders
Track Hoppers & Bin Gates
TELLEVEL Bin Level Controls
Water Intake Screens
SEALMASTER Ball Bearing Units

Write for a bulletin on any of the above

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5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

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F J Ardolino

VALVE KNOW-HOW comes from experience, in Fred Ardolino's case. In the past nine years he has helped operate and maintain all of New York City's modern sewage-treatment plants. (If you don't think they have plenty of valves, take a walk through one some day.) Fred is now senior stationary engineer (assistant to the superintendent) at Owl's Head sewage plant.

Born in Brooklyn, Fred graduated from famous Brooklyn Tech (so did Executive Editor Lou Rowley). Special courses extended this education, and he gives more than a little credit to his regular study of POWER's pages, both editorial and advertising.

Fred puts his job first, but likes tinkering with radio and TV, enjoys handball, swimming and ice skating.

...lines and bylines

H M Spring

OLD FRIEND to POWER readers (and editors) is Harry Spring. His many articles have been distinguished by a rare blend of technical knowledge and hard-to-get, practical "savvy."

Not unexpectedly, the same blend marks Harry's experience. He has operated and tested all kinds of plants, steam, hydro, electrical.

Building on a basic education in Boston Latin High School, Harry paralleled on-the-job learning with specialized technical training—in steam power, welding and metallography. And he has always increased his knowledge by active participation in the work of engineering societies in his fields of interest.

Beginning in 1934, a long association with Mutual Boiler & Machinery Insurance Co gave Harry broad contacts with plant men and intimate knowledge of their operating problems. As boiler inspector, assistant chief inspector and chief inspector, he accumulated the practical wisdom that made his articles and books (*Boiler Operators' Guide, Pressure Vessels for Industry*) so useful.

Now a busy consulting engineer, Harry finds less time for writing (although pp 114-115 seem to disprove it). He also misses out on hunting, fishing and gardening at his Canton, Mass. home.

READERS WANTING INFORMATION on new products, or copies of new free literature, have long used the handy reply cards forming part of our reader-service insert (p 165 this issue). And we're always working on new ideas to make this service easier and faster.

Right now, we're greatly encouraged by results of a new way of processing these cards, a method that speeds the reader requests to the manufacturers involved. Here's how it works: Let's say 57 readers ask for more dope on new equipment item No. 504, just as John Doe did on the sample card reproduced below.

We sort out all cards listing item No. 504, group them, and make a photocopy. At one step this gives the maker of the item a verified list of names and addresses of engineers interested in more info on his product. He then gets busy and sends out the stuff.

But—and here we need *your* help—the manufacturer won't be able to send your information unless your name, title, company, and *company* address are *legibly* printed on your card. *And make sure you use black or blue ink*—otherwise, the photocopy doesn't reproduce clearly and your request is held up or, perhaps, can't be filled.

I want details on these New Products...

504	553	508	556		

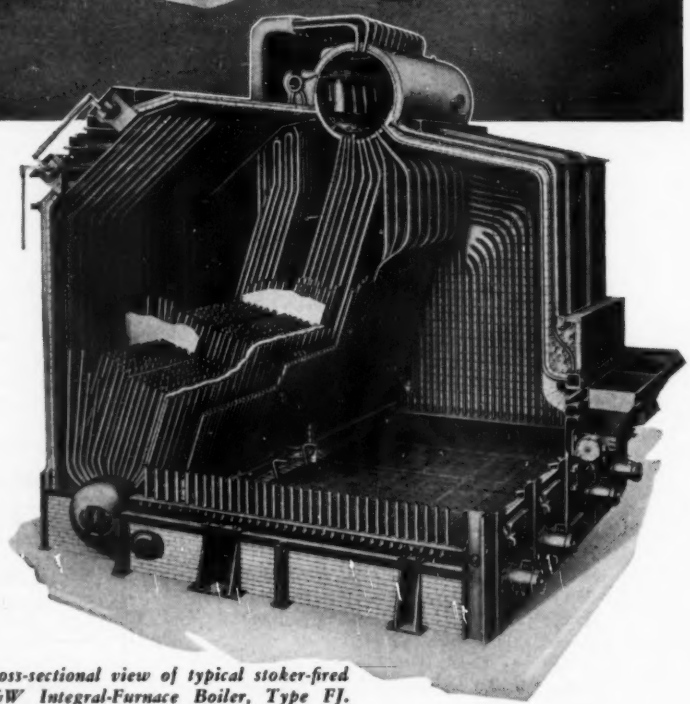
Send me these FREE Catalogs and Bulletins...

5	13	21	46	50	57			

My Name John J Doe
(Please print)
Title Power Supt
Company Perfect Mfg Co
Street Address 1056 Wisconsin Ave
City, State Milwaukee 5, Wis

Please mail before September 1, 1953. Void after this date.

Shown observing combustion conditions in one of Maywood Chemical's new B&W Integral-Furnace Boilers, Type FJ, Frank Green, Chief Engineer, reports complete satisfaction with their performance . . . verifies fuel savings up to 25%.



Cross-sectional view of typical stoker-fired B&W Integral-Furnace Boiler, Type FJ. Suitable for coal, gas, and oil firing, it is available in a steam capacity range from 30,000 to 70,000 lb per hr at pressures to 800 psi. For a detailed description of design and operating features, write for Bulletin G-70. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

2 B&W Integral-Furnace Boilers CUT COSTS $300 PER OPERATING DAY

at MAYWOOD CHEMICAL WORKS

To assure a constant and reliable steam supply under conditions where demand varies between 35,000 and 100,000 lb per hr, Maywood Chemical Works recently placed in service two stoker-fired B&W Integral-Furnace Boilers, Type FJ. These units replaced eight old boilers that were not producing steam efficiently or in sufficient quantity to meet plant requirements. Each new boiler has a design capacity of 55,000 lb per hr at 150 psi, and is designed to burn oil from a side wall, without disturbing the stokers now in use for coal firing. As a direct result of the change-over, steam capacity is up, while fuel, operating labor, and maintenance costs are reduced by substantial amounts . . . fuel savings alone are estimated at between 20 and 25%.

Concerning performance of the new B&W Units, Mr. Frank Green, Chief Engineer of Maywood Chemical is enthusiastic. "Boiler response is excellent . . . as high as 50,000 lb per hour in a minute for the two units. Cheaper grade of fuel is burned efficiently and steam pressure is steady and continuous. Although boilers are equipped with soot blowers they are not needed and are not used. Our previously serious fly-ash problem has been substantially reduced."

After installation plans were made by Maywood's consulting engineers, A. Wilson and Co., B&W took over the complete boiler erection job. B&W service engineers then started up the boilers for a thorough operational check before turning them over to Maywood Chemical as complete, efficient, in-service units.

COST SAVING FEATURES

of B & W Integral-Furnace Boilers for Steam Requirements from 2,800 to 350,000 Lb. Per Hr.

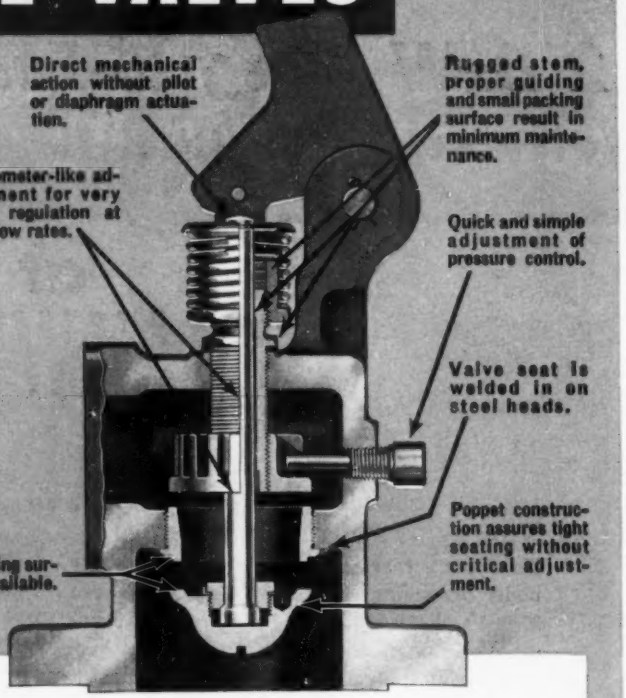
- Minimum floor space and headroom requirements
- High fuel economy
- Smokeless combustion
- Adaptable to all fuels and firing methods
- Economical fast steaming
- Water-cooled furnace
- Clean, dry steam at all ratings, even with high boiler water concentration
- Quick response to wide and heavy load swing demands
- Easy to inspect and clean
- High availability with least attention

BABCOCK & WILCOX

G-599

POPPET TYPE VALVES

An IMPORTANT REASON for the better performance of *these* DIAMOND Blowers

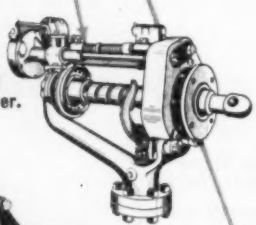

Direct mechanical action without pilot or diaphragm actuation.
Rugged stem, proper guiding and small packing surface result in minimum maintenance.
Micrometer-like adjustment for very close regulation at low flow rates.
Quick and simple adjustment of pressure control.
Valve seat is welded in on steel heads.
Poppet construction assures tight seating without critical adjustment.
Stellited seating surfaces are available.

Note carefully the important advantages pointed out on the illustration above. You will see why Diamond Poppet Type has proved its superiority by many years of successful operation on the most difficult jobs.

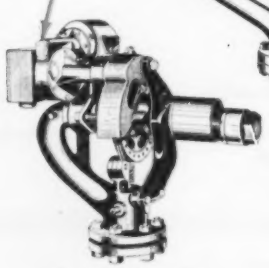
The integral adjustable pressure control device is used when boiler or header pressure is higher than desirable for blowing. Its location outside the path of valve travel permits full and immediate opening of the poppet valve, thus avoiding wire drawing.

The valve readily lends itself to examination and repair. Disc and seat are quickly accessible, and regrinding can be done quickly without dismounting the head. Seat and disc are forged and the stem rolled from stainless steel.

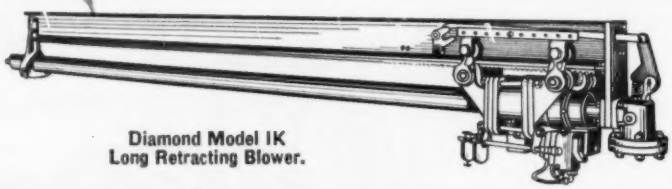
This valve construction is one of the many reasons why Diamond Blowers give better boiler cleaning at lower cost.



Diamond Model IR
Short Retracting Blower.



Diamond Model G9B
Automatic Valved Blower.



Diamond Model IK
Long Retracting Blower.

50th ANNIVERSARY 1903-1953

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited, Windsor, Ontario

6258

DIAMOND BLOWERS PREDOMINATE

on Stations with HEAT RATES* LESS THAN 11,000 btu during 1951

*From FPC report entitled "Steam Electric Plant Construction Cost and Annual Production Expenses for 1951."

Evidence continues to mount showing the dollars-and-cents value of Diamond Blowers. For example, the heat rate information shown at the right. It is taken from the annual report issued by the Federal Power Commission. As may be seen, an overwhelming majority of the stations with the best records of "Average Btu per Kilowatt-hour Net Generation" in 1951 are equipped with Diamond Blowers.

Low heat rates are impossible unless boilers are kept clean. And, correct cleaning not only improves heat rates, but also the availability of boilers.

Diamond, with 50 years experience, has the equipment and the knowledge of blower application to assure correct boiler cleaning . . . and at lowest overall cost.

Check this list for yourself . . . it is another reason for the wide preference for Diamond Blowers.

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
DIAMOND SPECIALTY, LIMITED
WINDSOR, ONTARIO

50th ANNIVERSARY

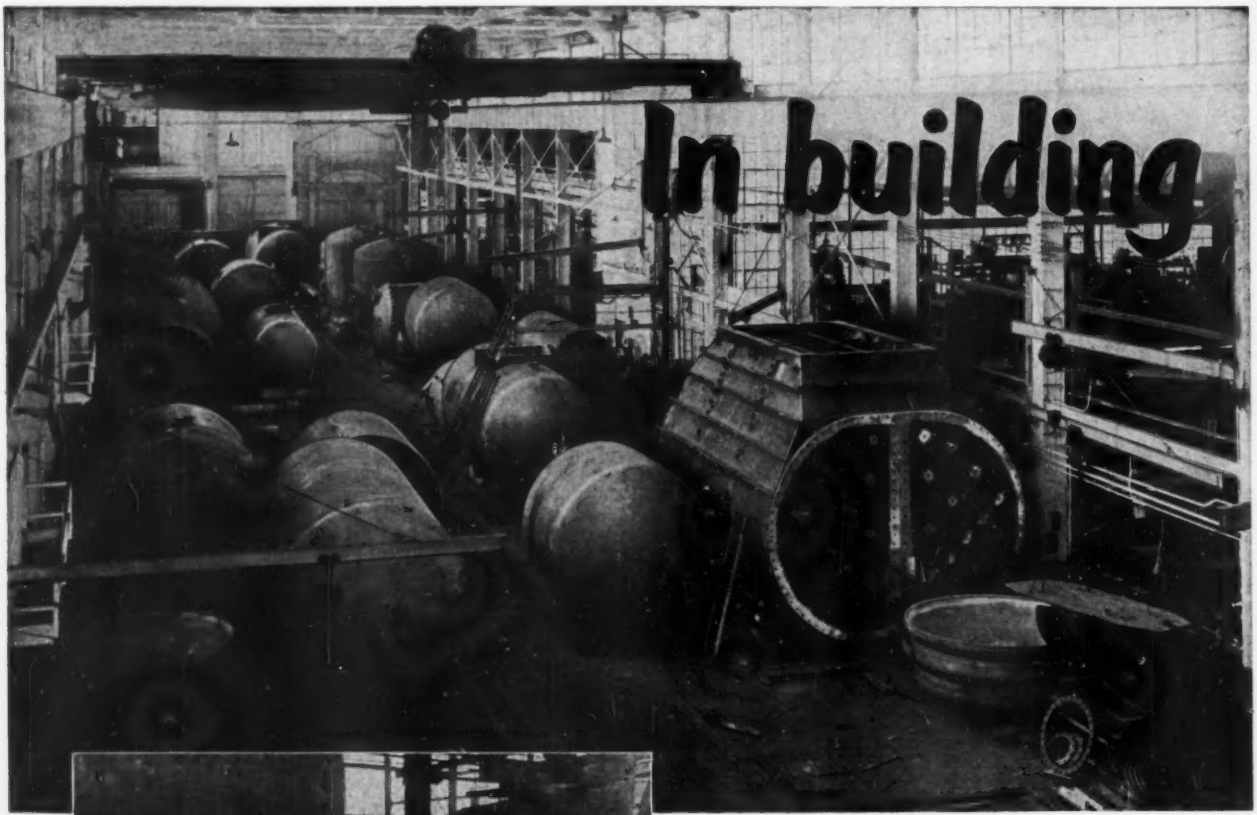
Proof of BETTER Boiler Cleaning

STATION	UTILITY COMPANY	HEAT RATE* btu/kwhr
◆ Tanners Creek	Indiana & Michigan Electric Company	9,354
◆ Schiller	Public Service Co. of New Hampshire	9,379
◆ Philip Sporn	Appalachian Electric Power Company	9,418
Dunkirk	Niagara Mohawk Power Company	9,540
Titus	Metropolitan Edison Company	9,886
◆ W. S. Lee	Duke Power Company	9,954
◆ Cecil Lynch	Arkansas Power & Light Company	10,170
◆ Pt. Washington	Wisconsin Electric Power Co.	10,329
◆ O. H. Hutchings	Dayton Power & Light Company	10,372
Russel #7	Rochester Gas & Electric Company	10,515
◆ Goldsboro	Carolina Power & Light Company	10,518
◆ Ridgeland	Commonwealth Edison Company	10,560
◆ Dan River	Duke Power Company	10,642
◆ Sewaren	Public Service Elec. & Gas Company	10,690
◆ Oswego	Niagara Mohawk Power Corp.	10,805
◆ Edge Moor	Delaware Power & Light Company	10,810
◆ Potomac River	Potomac Electric Power Company	10,918
◆ Lumberton	Carolina Power & Light Company	10,981
◆ Yates	Georgia Power Company	10,986

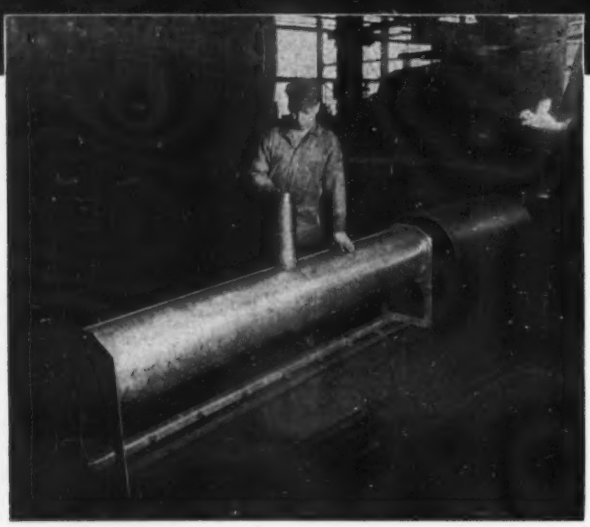
◆ *Stations having Diamond Blowers*

LOW HEAT RATES (AND HIGH AVAILABILITY) DEMAND CLEAN BOILERS AS WELL AS ADVANCED STATION DESIGN

In building

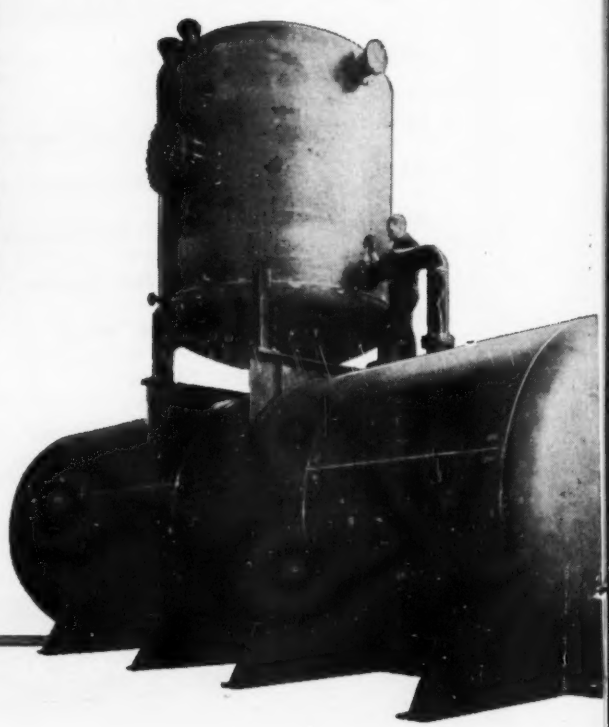


Assembly line in Elliott Company welding shop.



THE LATEST DESIGN *of Elliott deaerating heater incorporates this stainless steel vent collecting hood, which with the inlet spray assembly is located inside the shell at the top. This replaces the former tubular vent condenser located outside the shell in older designs, requires no maintenance beyond occasional inspection, and simplifies headroom problems.*

At right, a 975,000-lb-per-hr Elliott vertical deaerating feedwater heater, mounted on its storage tank, set up for final testing in the Elliott shops. A notable feature is that stainless steel is used throughout wherever there is contact with corrosive water. This includes the trays which are of fabricated stainless steel and light in weight.



deaerating heaters

ELLIOTT

does the whole job!

Users of Elliott deaerating heaters enjoy the assurance that the entire construction of each unit is Elliott shop-built all the way through. No responsibility for any part of the construction is delegated to an outside organization. Elliott quality is rigidly maintained right from the bending of the first plate to the welding of the last inch of joint. The entire unit is set up, hydrostatically tested, dismantled, and loaded on flatcars for shipment. At no time has the heater or any part of it, been outside the Elliott plant.

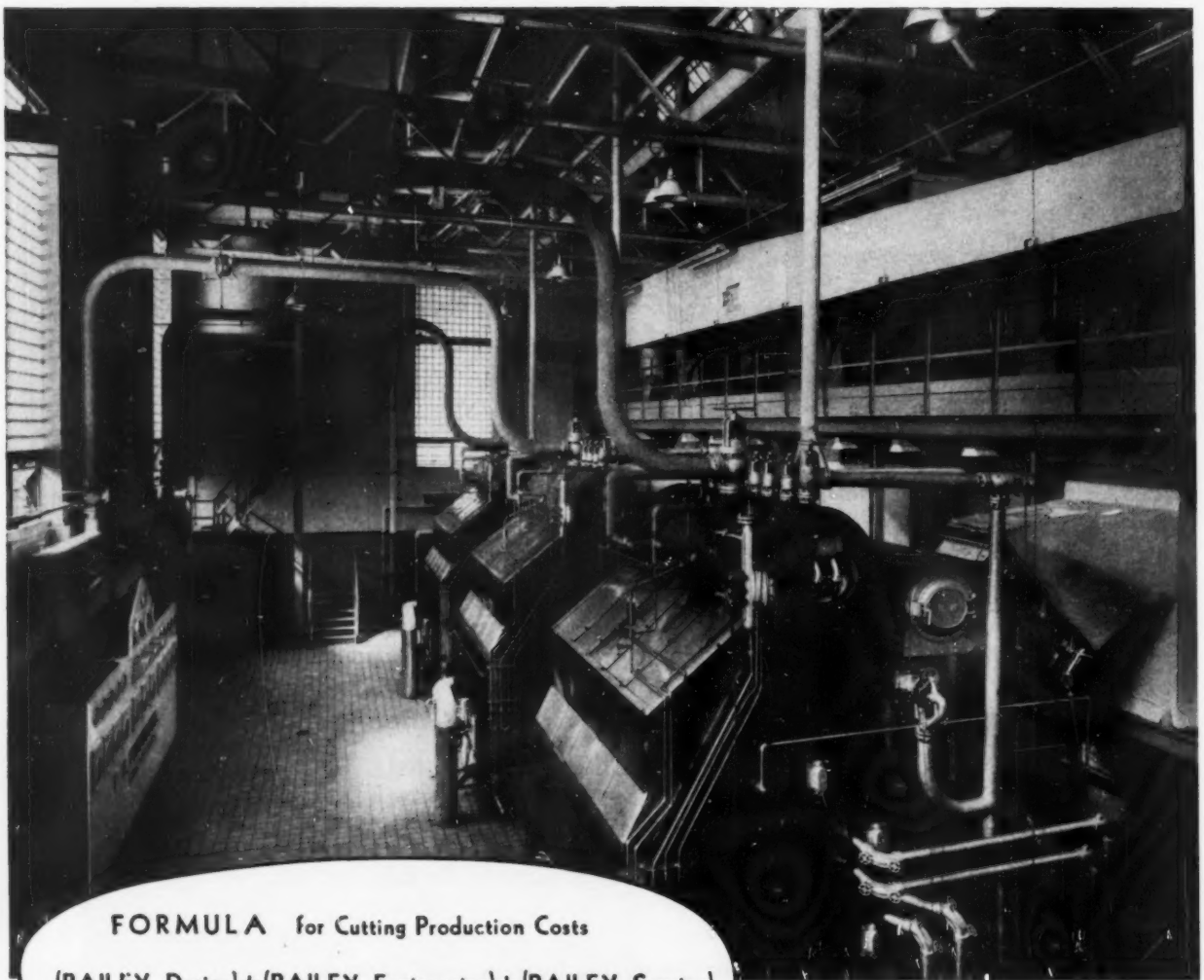
For full details on Elliott deaerating heaters, contact your local Elliott representative or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

N3-1

DEAERATOR AND HEATER DEPARTMENT

How to



FORMULA for Cutting Production Costs

(BAILEY Design) + (BAILEY Engineering) + (BAILEY Service)

= GREATER SAVINGS PER FUEL DOLLAR

In the Nela Park central heating plant of General Electric Company, Bailey Meter Control insures efficient use of fuel. It enables operators to run these 18,000 lb per hour 125 psi spreader stoker-fired boilers under optimum conditions at all times.

Save Fuel

★ The productive energy produced by a unit of fuel depends on the way you put it to work in your boiler. How much heat energy you actually get depends upon the performance of your steam plant equipment.

That's where Bailey Controls can help. With a Bailey-engineered control system, you can count on a higher output of available energy per unit of fuel. Here's why:

1. Complete Range of Equipment—fully co-ordinated

You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, as might be the case if he had only a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control *systems*.

2. Engineering Service—backed by experience

No other manufacturer of instruments and controls can offer as broad an experience based on succesful installations involving all types of combustion, flow measurement, and automatic control.

3. Direct Sales-Service—conveniently located near you

Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum travel-time and expense.

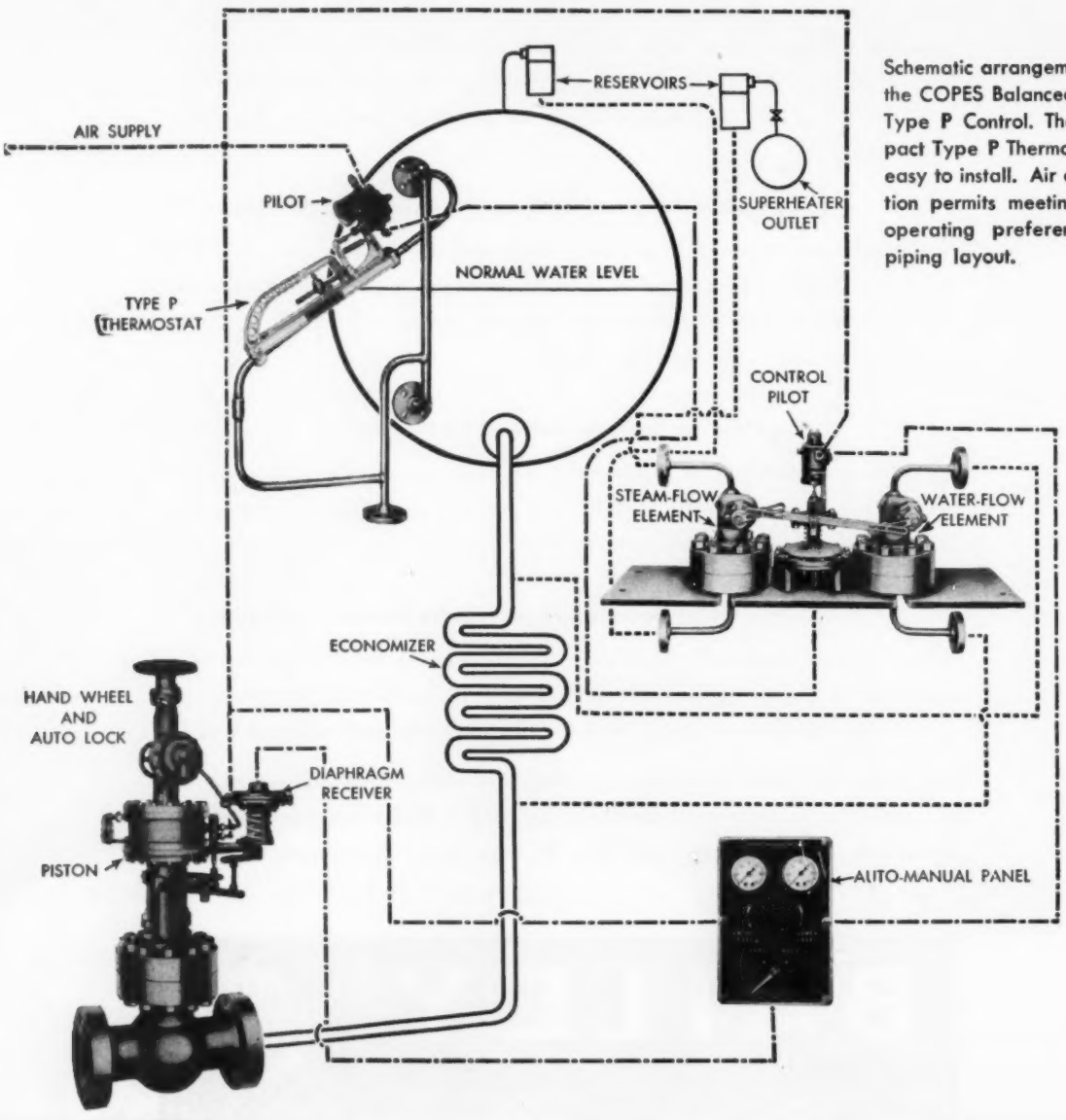
For greater fuel savings, less outage, and safer working conditions you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record.

A-117-2

BAILEY
METER COMPANY
1036 IVANHOE ROAD
CLEVELAND 10, OHIO
Complete Controls for Steam Plants

BAILEY METERS
Controls for
COMBUSTION
FEED WATER
TEMPERATURE
PRESSURE
LIQUID LEVEL
FEED PUMPS

OHIO EDISON



Schematic arrangement of the COPES Balanced Flow Type P Control. The compact Type P Thermostat is easy to install. Air operation permits meeting any operating preference or piping layout.

COPES BOILER FED

INSTALLS COPES

Balanced Flow Feed Control for cyclone-fired pressurized-furnace, reheat steam generators at new NILES STATION

Three-influence COPES Balanced Flow Control will handle the boiler feed on two 885,000-pounds-per-hour boilers at Niles Station.

This modern regulator combines the influences of steam flow, water flow and water level to assure a stable drum level, for safety—and a rate of feed in accordance with load demands, for efficiency.

Completely independent, the COPES Balanced Flow can remain on fully-automatic when other instruments and controls must be out of service for any reason.

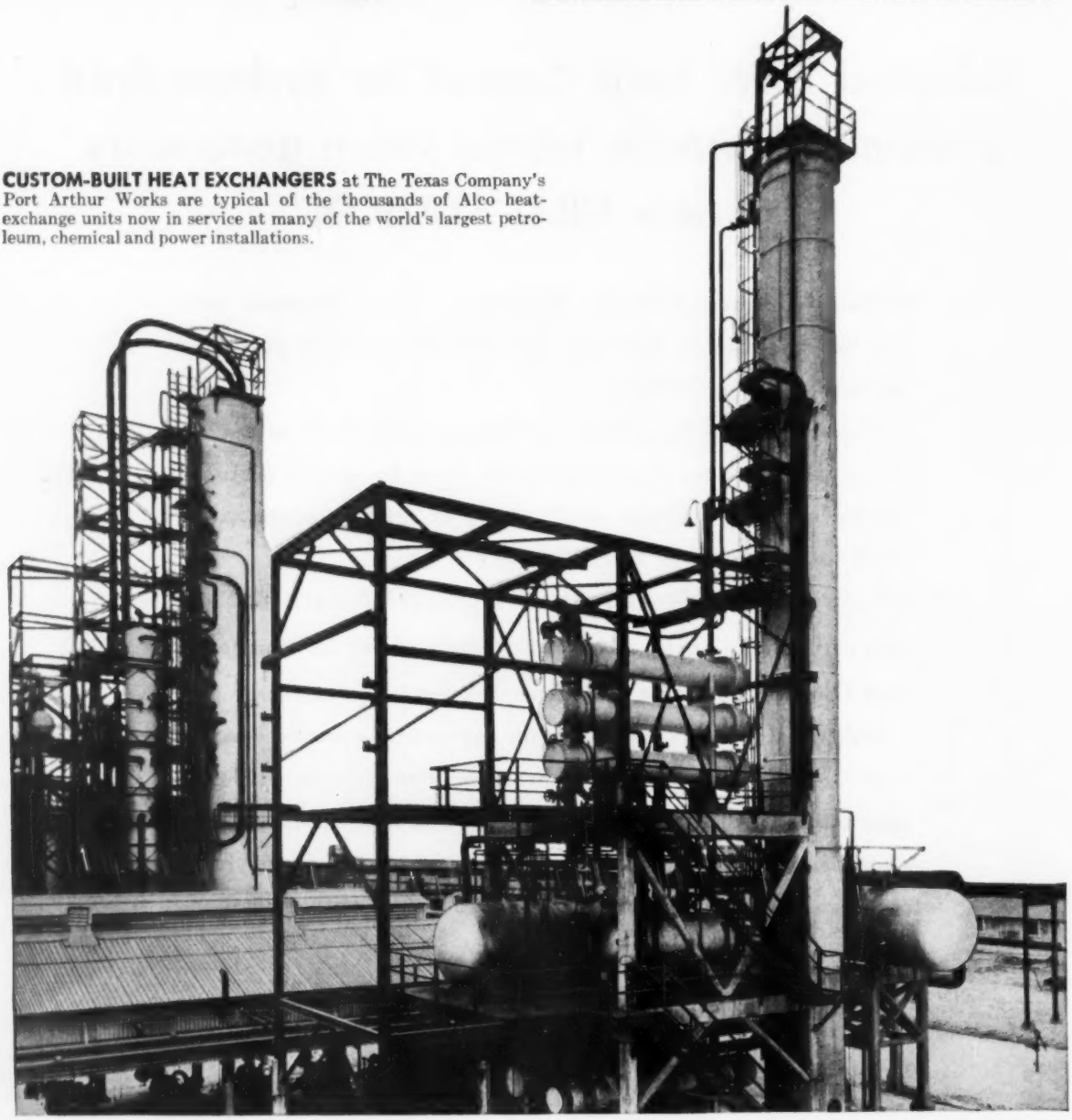
Subject to few outages—even for routine maintenance—and easily adjusted for changed conditions while in operation, the COPES Balanced Flow is recommended for those high-duty steam generators which demand high regulator availability. The facts are yours on request.

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA

WATER REGULATION

demanded by growth and

Alco Answers to



CUSTOM-BUILT HEAT EXCHANGERS at The Texas Company's Port Arthur Works are typical of the thousands of Alco heat-exchange units now in service at many of the world's largest petroleum, chemical and power installations.

Hundreds of new industrial problems call for new and varied types of heavy metal equipment. More and more frequently, the answers are designed and built by Alco.

Alco's experience in the heavy equipment field is unsurpassed. You will find Alco products today in power, petroleum, chemical and manufacturing plants all over the world.

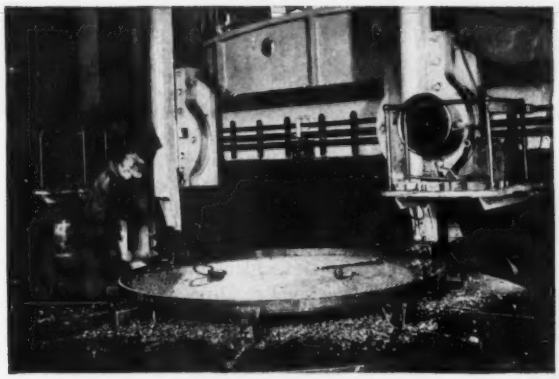
Alco's production and testing facilities are modern and complete. At the 31-acre Alco plant at Dunkirk, N. Y., the most difficult of metal-fabricating operations are handled with maximum speed and efficiency.

If your own industrial problems call for the kind of heavy metal equipment you see on these pages—the kind that can meet your strictest specifications—send the details to your nearest Alco Products Sales Engineer.

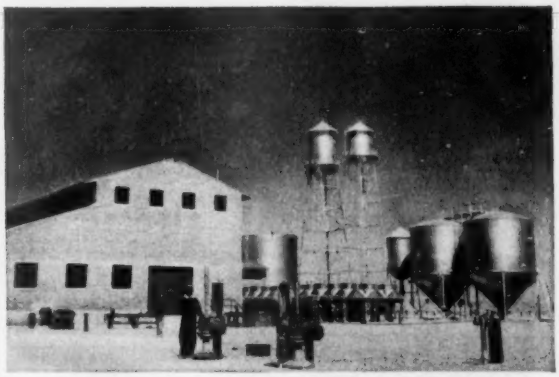
You will find him at New York, Chicago, Los Angeles, Kansas City, Houston, Tulsa or Beaumont. Or write direct to Dunkirk.

progress...designed and built by Alco

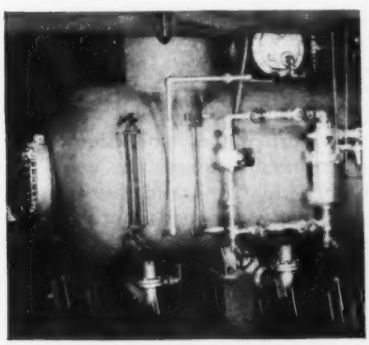
New Industrial Problems



LARGE DIAMETER BORING MILL at Alco's recently expanded Dunkirk plant is equipped with heads for both straight and bevel work. This is one of the many special machines that enable Alco to produce efficient, economical answers to hundreds of new industrial problems.

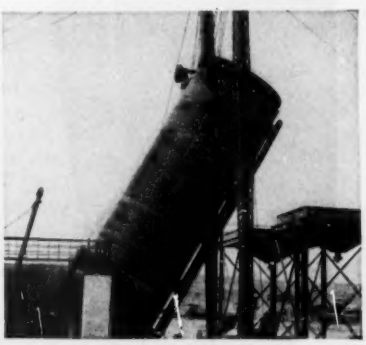


21 ALCO AIRCOOLERS handle all water cooling requirements at each of four pumping stations on the Trans-Arabian Pipe Line—with ambient temperatures as high as 122 F! Available in either radiator-core or fin-tube types, Alco Aircoolers offer a means to lower cooling costs for scores of applications.



FLEX-TUBE EVAPORATOR at New York State Electric and Gas Corporation's Hickling Station was designed and built by Alco to produce vapor under controlled conditions, of not more than 0.5 parts of total solids. Patented Flex-Tube construction greatly facilitates removal of scale

25,000 FT OF ALCO STEEL PIPE help furnish the Arnold Engineering Development Center of the USAF with 100,000 gallons of cooling water per minute. Over the years, Alco has produced pipe of all shapes, sizes and materials for many of the largest industrial and municipal piping installations.



125-TON REGENERATORS for El Paso Natural Gas Company's new gas-turbine pumping installation are 10 ft in diameter, 33 ft long and contain over 5000 tubes. Units like these illustrate the wide range of special heavy-metal equipment designed and fabricated by Alco to meet virtually any specifications.

ALCO

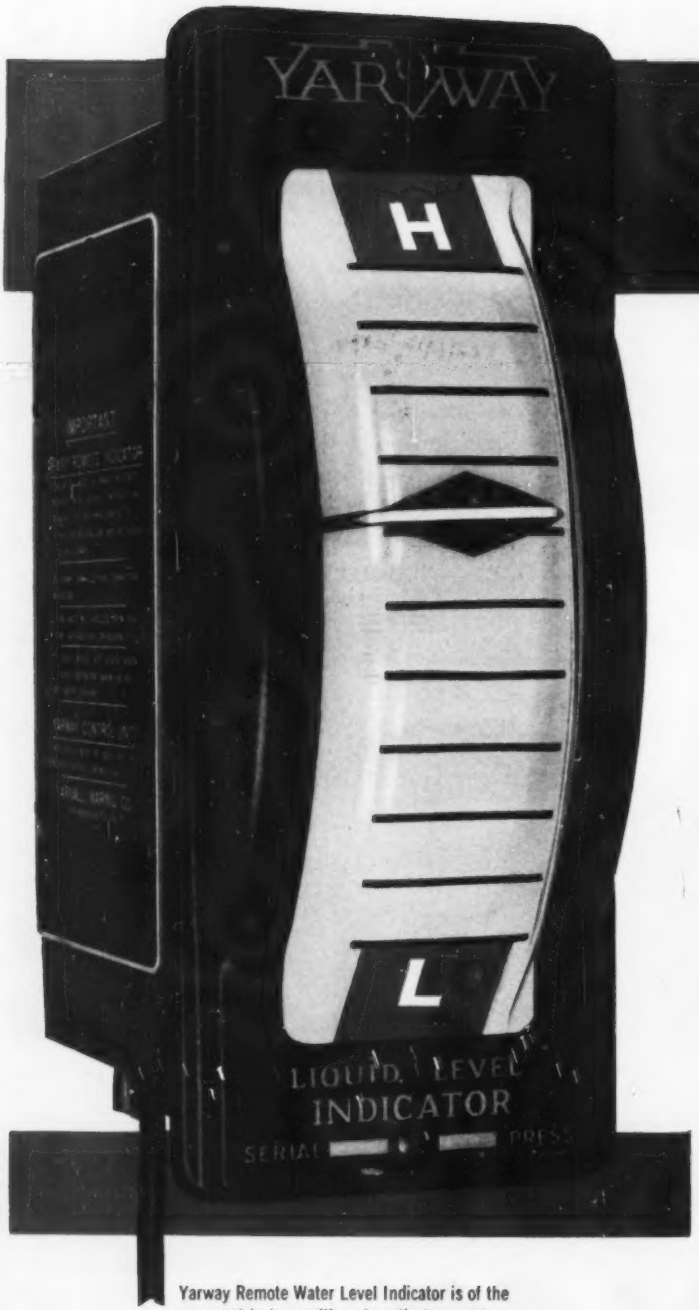
ALCO PRODUCTS DIVISION

AMERICAN LOCOMOTIVE COMPANY • DUNKIRK, NEW YORK

new

WIDER VISION

for easier remote boiler water level readings



Yarway Remote Water Level Indicator is of the manometric type with automatic temperature compensation. Note new "wide vision" face. See Yarway Bulletin WG-1823.

■ Vastly improved visibility of remote boiler water level readings can now be enjoyed by boiler plant operators.

The new "wide vision" face on Yarway Remote Liquid Level Indicators allows reading from the side as well as the front of the indicator.

Boiler water levels and other liquid levels can be checked from most any position in the control room or wherever the Yarway Indicator is installed.

Indicating mechanism is operated by the boiler water level itself, assuring instant, accurate readings. Indicating mechanism is never under pressure. There are no stuffing boxes.

Over 10,000 Yarway Remote Liquid Level Indicators are successfully used throughout industry—primarily for indicating boiler water levels, but also other liquid level applications, and for super-heater pressure differential indication aboard ship.

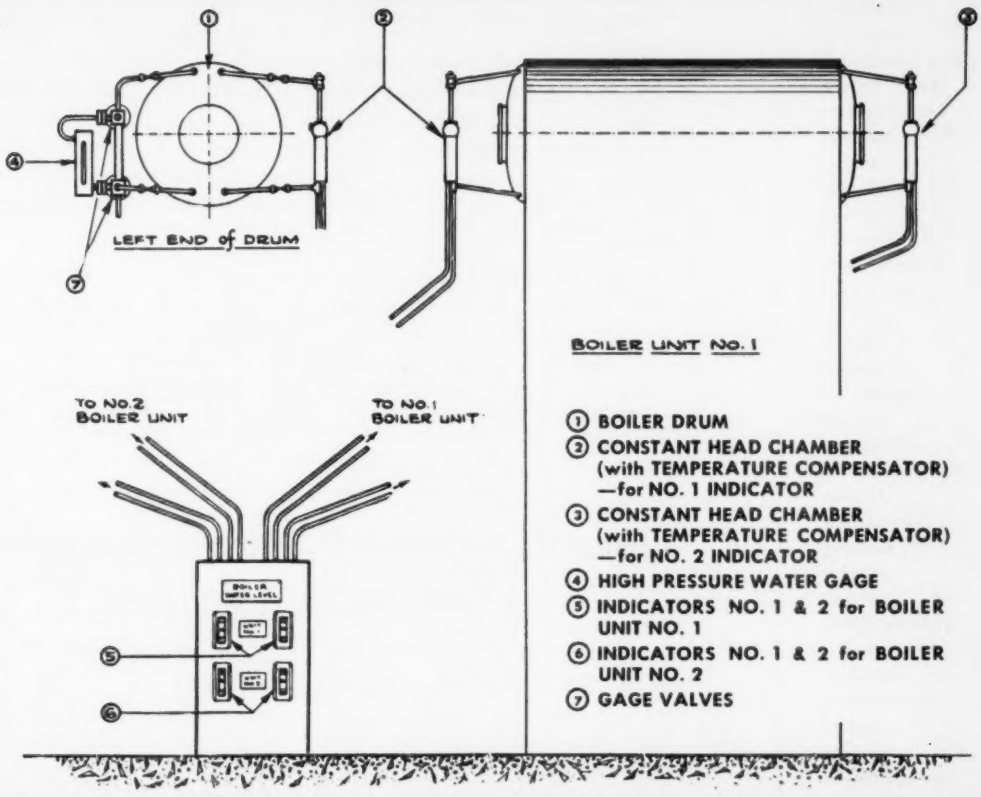
APPROVED MANOMETRIC TYPE

Yarway Remote Liquid Level Indicators are of the manometric type, with automatic temperature compensation, as approved for use under the new ruling of the A.S.M.E. Boiler Code Committee as covered in Code Case #1155, which permits the use of two remote indicators in place of one of the high pressure boiler water gages on boilers over 900 psi.

Additional information—write

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

Suggested installation of Yarway Remote Liquid Level Indicators and High Pressure Water Gages as now permitted by the A.S.M.E. Boiler Code.


LEFT END of DRUM
BOILER UNIT No. 1
TO NO. 2 BOILER UNIT
TO NO. 1 BOILER UNIT
① BOILER DRUM
② CONSTANT HEAD CHAMBER (with TEMPERATURE COMPENSATOR) —for NO. 1 INDICATOR
③ CONSTANT HEAD CHAMBER (with TEMPERATURE COMPENSATOR) —for NO. 2 INDICATOR
④ HIGH PRESSURE WATER GAGE
⑤ INDICATORS NO. 1 & 2 for BOILER UNIT NO. 1
⑥ INDICATORS NO. 1 & 2 for BOILER UNIT NO. 2
⑦ GAGE VALVES

YARWAY® | *remote liquid level indicators*

Industries served by VU Boilers

Aircraft
Asphalt
Automobile
Breweries
Building Materials
Carpet
Cellophane
Cement
Chemical
Coal Mining
Coke
Cold Storage
Dairy
Department Stores
Distilling
Explosives
Electrical Equipment
Electric Power
Food Products
Foundries
Gas Works
Gelatine
Glass
Hosiery
Knitting Mills
Institutions
Laundries
Leather
Linoleum
Locomotive
Lumber
Machinery
Metal Producing
Mining
Municipal
Oil Refining
Paint
Paper
Public Utilities
Radio
Railways
Refrigeration
Rubber
Schools
Sewage Plants
Shipbuilding
Sugar
Textile
Tobacco
U. S. Government

LEADING CHEMICAL

In industry after industry, you'll find leading companies are setting the pace for efficient, reliable steam production with C-E Vertical-Unit Boilers.

The Chemical Industry is a typical example. For VU Boilers have been purchased by most of the major manufacturers in this industry, including such nationally-known leaders as those shown in the list below.

Furthermore, chemical manufacturers, both large and small, have evidenced their satisfaction with Vertical-Unit Boilers by buying them again and again. In the past two years, for example, more than 50 per cent of the VU capacity ordered by chemical companies represented repeat order business. One leading manufacturer, in fact, has purchased twenty-seven units during the past thirteen years — *eleven of them in 1951!*

You can profit from the experience of the Chemical Industry — as from any industry where steam for power or process is of major importance. If you use steam, investigate the lower steam costs you can get through the advanced design . . . sound construction . . . proved reliability of VU Boilers. They are available in capacities to fit your needs—from 10,000 to 350,000 pounds of steam per hour.

Typical List of Chemical Companies that have purchased VU Boilers for one or more plants

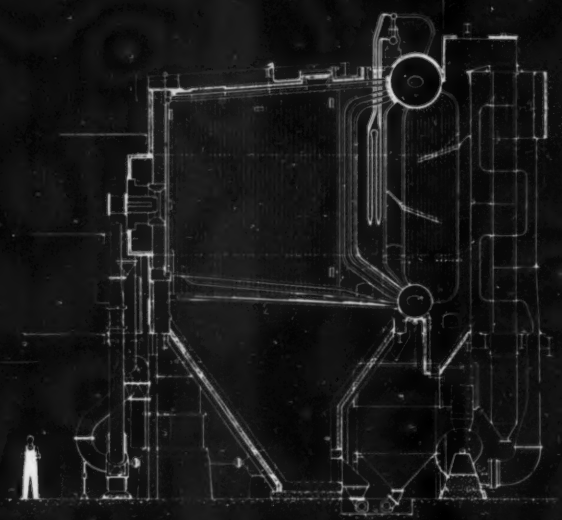
Air Reduction Co., Inc.
Allied Chemical & Dye Corp.
Atlas Powder Co.
Carbide & Carbon Chemical Corp.
Colgate-Palmolive-Peet Co.
Diamond Alkali Co.
E. I. du Pont de Nemours & Co., Inc.
B. F. Goodrich Chemical Co.
Hercules Powder Co.
Merck & Co., Inc.
National Distillers Chemical Co.
Pennsylvania Salt Mfg. Co.
Pittsburgh Coke & Chemical Co.
Charles Pfizer & Co.
Shell Chemical Co.
U. S. Industrial Chemicals Co.

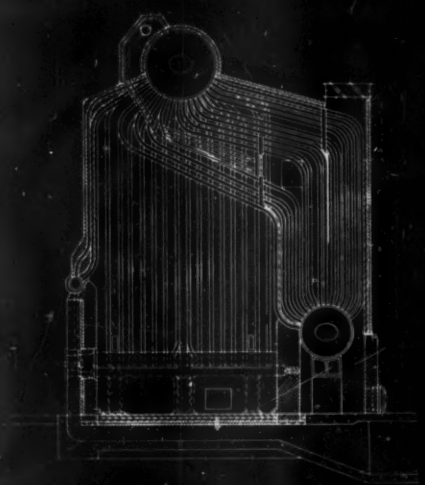
COMBUSTION ENGINEERING, *Inc.*

200 Madison Avenue • New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

VU





1 VU-50 BOILER installed in Midwestern plant. This boiler is fired with pulverized coal using C-E Raymond Bowl Mills. The capacity is 65,000 lb of steam per hr. Steam pressure is 400 psi — steam temperature is 600 F.

2 VU-10 BOILER fired with oil. Installed in an Eastern plant, the boiler's capacity is 15,000 lb of steam per hr at 250 psi and 480 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr. They may also be fired by spreader, underfeed or chain grate stokers.

3 VU-40 BOILER installed in a large Southern plant. This unit is fired by coal, using C-E Spreader Stokers (continuous discharge type). Capacity of this boiler is 150,000 lb of steam per hr at a pressure of 900 psi and a temperature of 808 F.

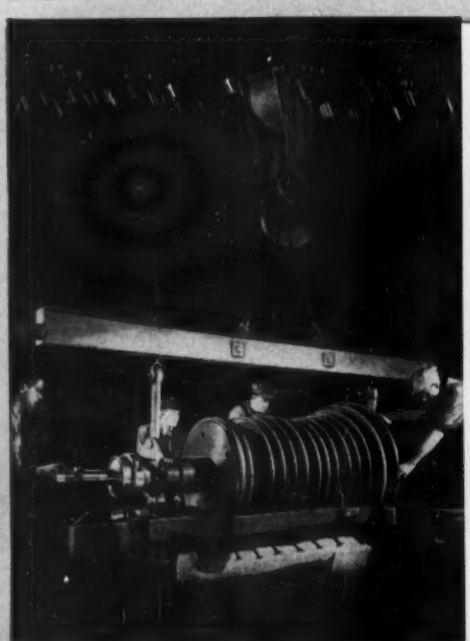
From Shop

HERE'S HOW Allis-Chalmers Builds the Generator Unit that's Easy to Install, Low in Foundation Cost

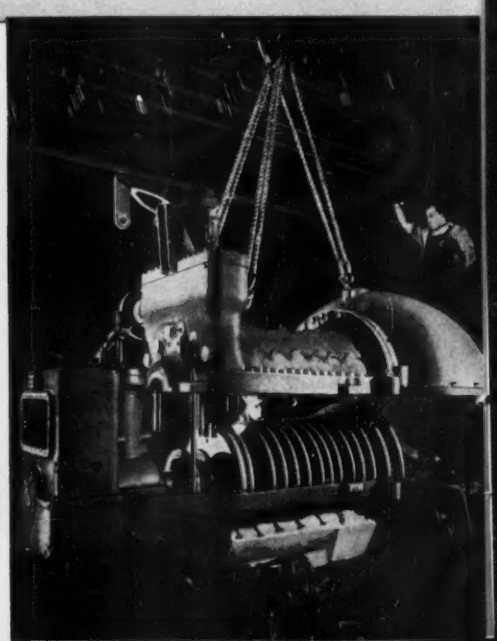
MODERN Allis-Chalmers WA-Series steam turbine generating units are factory tested and shipped with rotors locked in place to save you installation time. Oil piping and generator air coolers are both above the floor line to reduce your foundation costs.

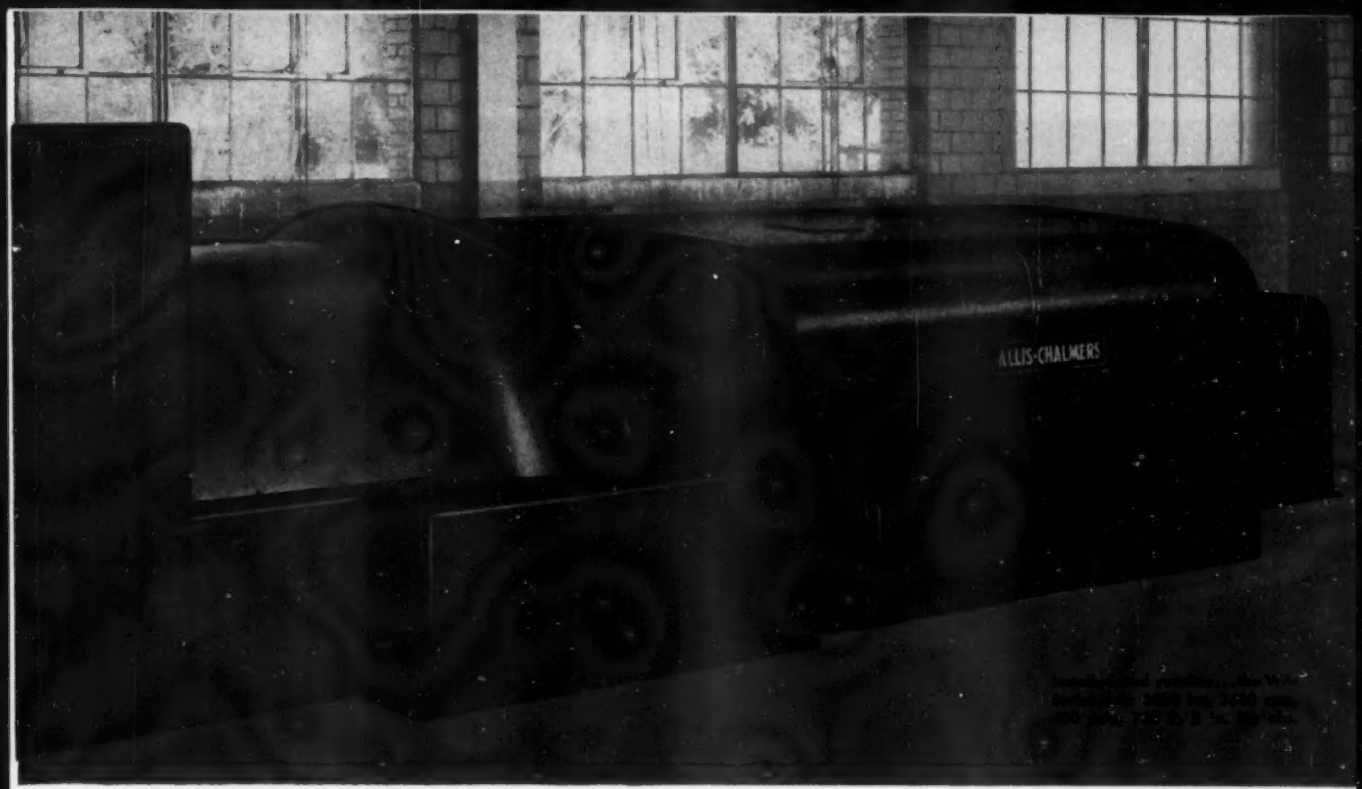
WA-Series units are built in ratings from 2000 to 7500 kw for either condensing or non-condensing operation. For your copy of Bulletin 03B7654, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3910

1 Precision balanced turbine rotor assembly being lowered into casing. All wheels have durable chrome alloy steel buckets.



2 Upper half casing of this compact Impulse steam turbine is next added in the process of assembling the WA-Series unit.





to Shipment!

3 Assembled 3-bearing unit — complete with housing type air cooled generator — ready for factory testing. Both oil piping and generator air coolers are above the floor line.

4 Entire WA-Series 3000-kw unit—pre-tested and insulated—being loaded on one flatcar for unit shipment. Both turbine and generator are shipped with their rotors securely locked in place.

ALLIS-CHALMERS

World's Widest Range of Power Plant Equipment

A-C ALLIS-CHALMERS

POWELL—a *trusted* name in flow control equipment

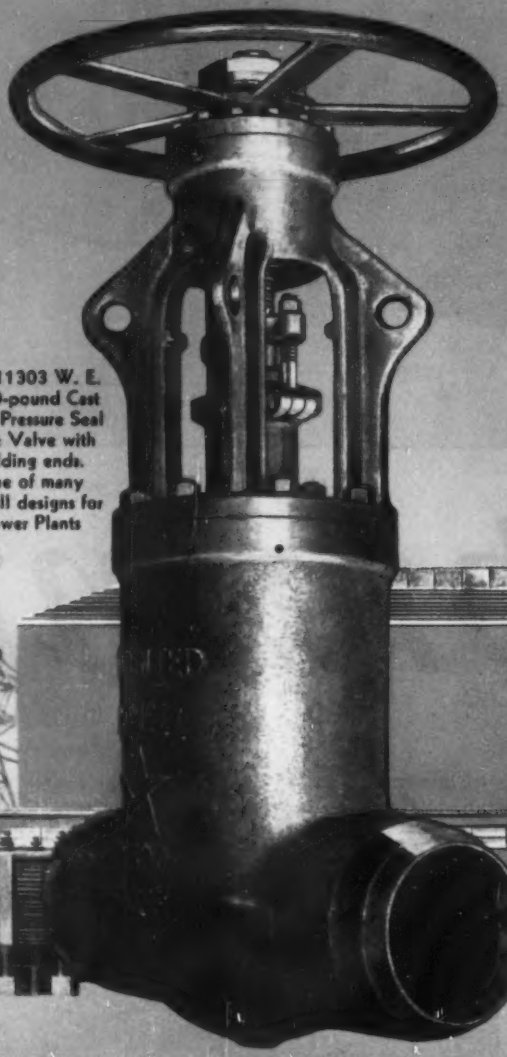


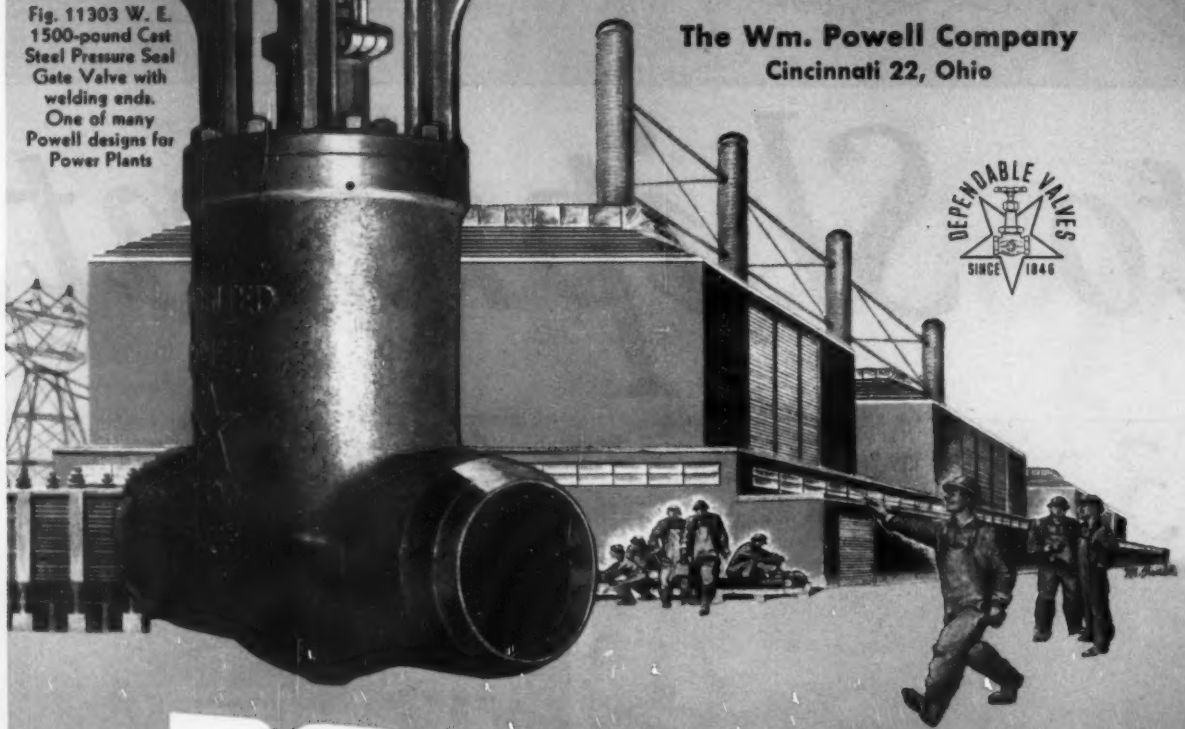
Fig. 11303 W. E. 1500-pound Cast Steel Pressure Seal Gate Valve with welding ends. One of many Powell designs for Power Plants

To be trustworthy is one of the finest attributes of mankind. In flow control equipment it is essential.

Through many years the actual service records of countless valves bearing the name "Powell" prove that they can always be trusted to give the utmost in dependable, trouble-free performance.

The Wm. Powell Company
Cincinnati 22, Ohio

DEPENDABLE VALVES SINCE 1846



POWELL

Fig. 1793—Large 125-pound Iron Body Bronze Mounted Gate Valve for water, oil, gas and low pressure steam services. Has outside screw rising stem, bolted flanged yoke and tapered solid wedge. Made in sizes 2" to 30", inclusive.

Fig. 1331-A—1500-pound Steel Integral Bonnet Offset Globe Valve with socket weld ends.

Fig. 6061 W. E.—600-pound Cast Steel Swing Check Valve with welding ends and bolted cap. Disc has ample lift to permit full, straightway, unobstructed flow through the valve body.

Fig. 2608—200-pound Bronze Globe Throttling Valve with special bronze stem and stainless steel disc and seat. A Powell design that permits full flow through seat when wide open.

Fig. 3031-W. E.—300-pound Cast Steel Globe Valve with welding ends, bolted flanged yoke and outside screw stem.

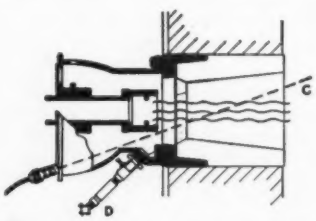
VALVES

IN BRONZE, IRON, STEEL AND CORROSION-RESISTING METALS AND ALLOYS

BOOM!

How fireye works

to give you complete flame failure protection...



1 — To eliminate dangerous gases in combustion chamber (from leaking shut off valve during down time of burner,) FIREYE purges chamber (C) before igniting pilot (D).

COVERING THE U.S.A.— and Canada, factory-trained field engineers provide "know how" of flame failure safeguarding with FIREYE.

"The day it rained biscuits" in Ames*, Massachusetts

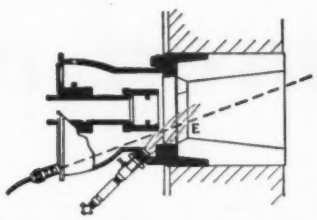
This Yankee classic was coined by a resident to describe the violence of the burner flame failure explosion in the local bakery. Damage of $130,000, and a year of non-production resulted from the hazard that exists in any building with unprotected fuel burning equipment.

**Actual town name upon request*

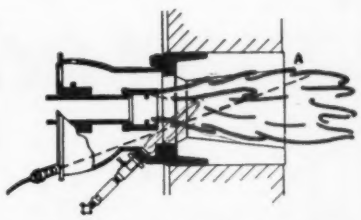
IN ANY PLANT not fully protected — even yours — an explosion can happen if the flame goes out in a fuel burner. Fuel continuing to pour in forms an explosive mixture in seconds . . . to be reignited explosively by the hot firebrick.

Partial protection, from safeguards that require more than a minute for response, can be as ineffective as *no* protection from this hazard. That is the reason insurance companies recommend the kind of protection given by FIREYE. They fully approve the FIREYE SYSTEM . . . the only complete and instantaneous flame failure safeguard controls for all types of fuels. An electronic "eye" works with the speed of light when a burner flame goes out, to eliminate all hazard and effect reignition automatically and safely.

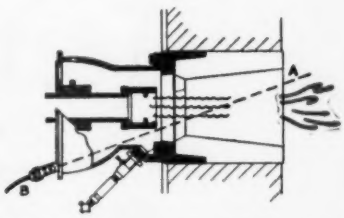
Over 10,000 installations prove FIREYE has no equal for reliability and effectiveness. It can be applied to any type of burner — oil, gas, coal — generally "overnight", and for only a few hundred dollars.



2 — Because pilot flame can fail to light off due to fouled electric ignitors, no fuel, or poor fuel-air mix, FIREYE proves pilot flame (E) is proper before turning on main fuel valve.



3 — If main flame (A) is not sighted at end of safe trial ignition period (due to no main fuel, poor fuel-air ratio or draft) FIREYE shuts down burner.



4 — If main flame (A) fails due to poor fuel-air ratio or draft, or fuel interruption, FIREYE shuts down burner in 2 to 4 seconds to prevent explosion of unburned gases.

fireye

PLAY SAFE! SEND NOW!

This could be the most important booklet you ever read

Why take chances? Even with modern power, processing or heating equipment, the chances are 4-to-1 you do not have complete flame failure safeguards. Send for this new "primer" on flame failure explosion hazards. It tells how you can simply check the protection you now have, and what you need.

COMBUSTION CONTROL CORP., Dept. PB 6
718 Beacon St., Boston, Mass.

Send me your free booklet "Guarding Your Plant Against Flame Failure Explosions".

Name.....*(Title)*.....

Firm.....

Address.....

General

teamed up

"More Power to You"

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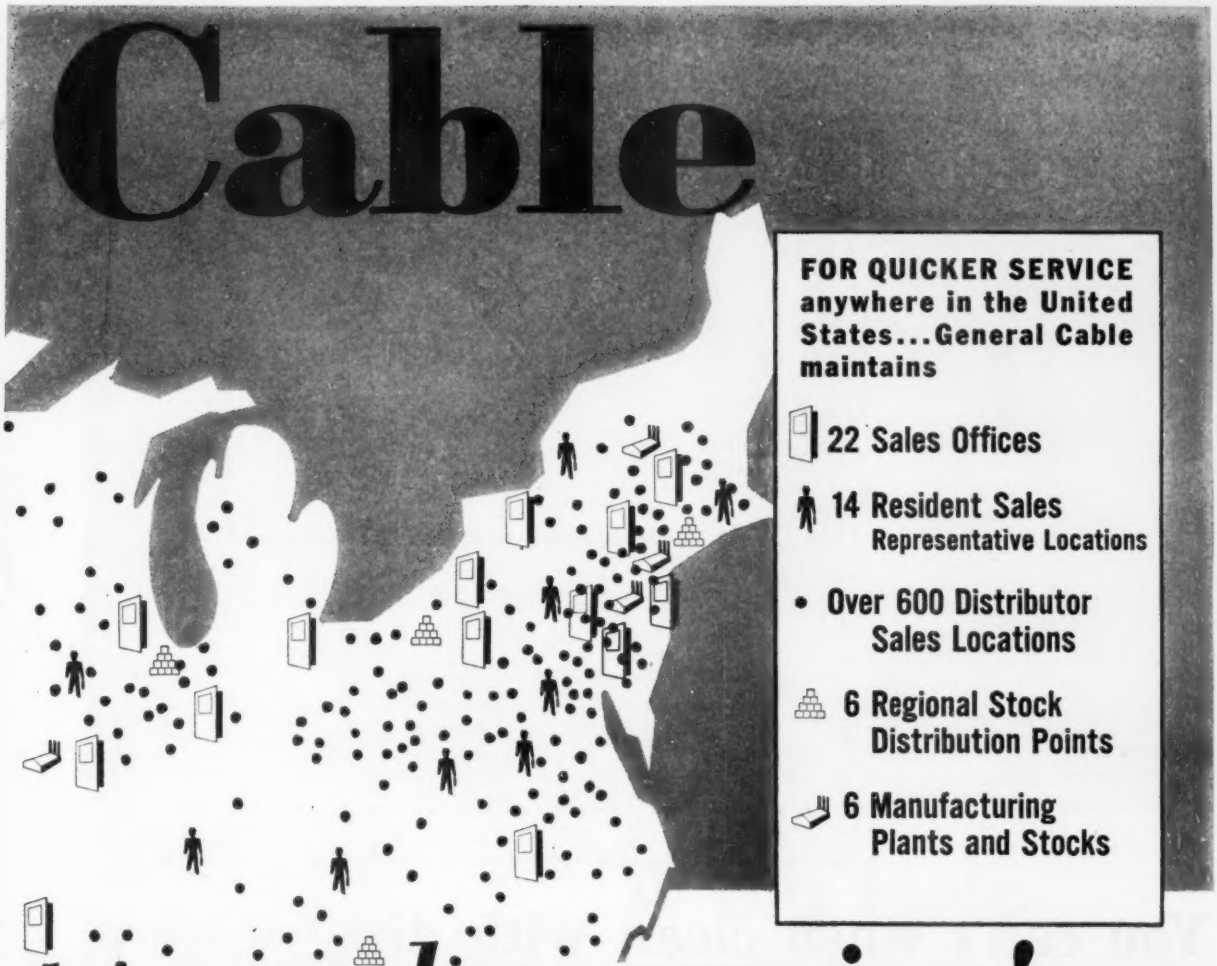
Cable



FOR QUICKER SERVICE anywhere in the United States...General Cable maintains

- 22 Sales Offices
- 14 Resident Sales Representative Locations
- Over 600 Distributor Sales Locations
- 6 Regional Stock Distribution Points
- 6 Manufacturing Plants and Stocks

to render service!

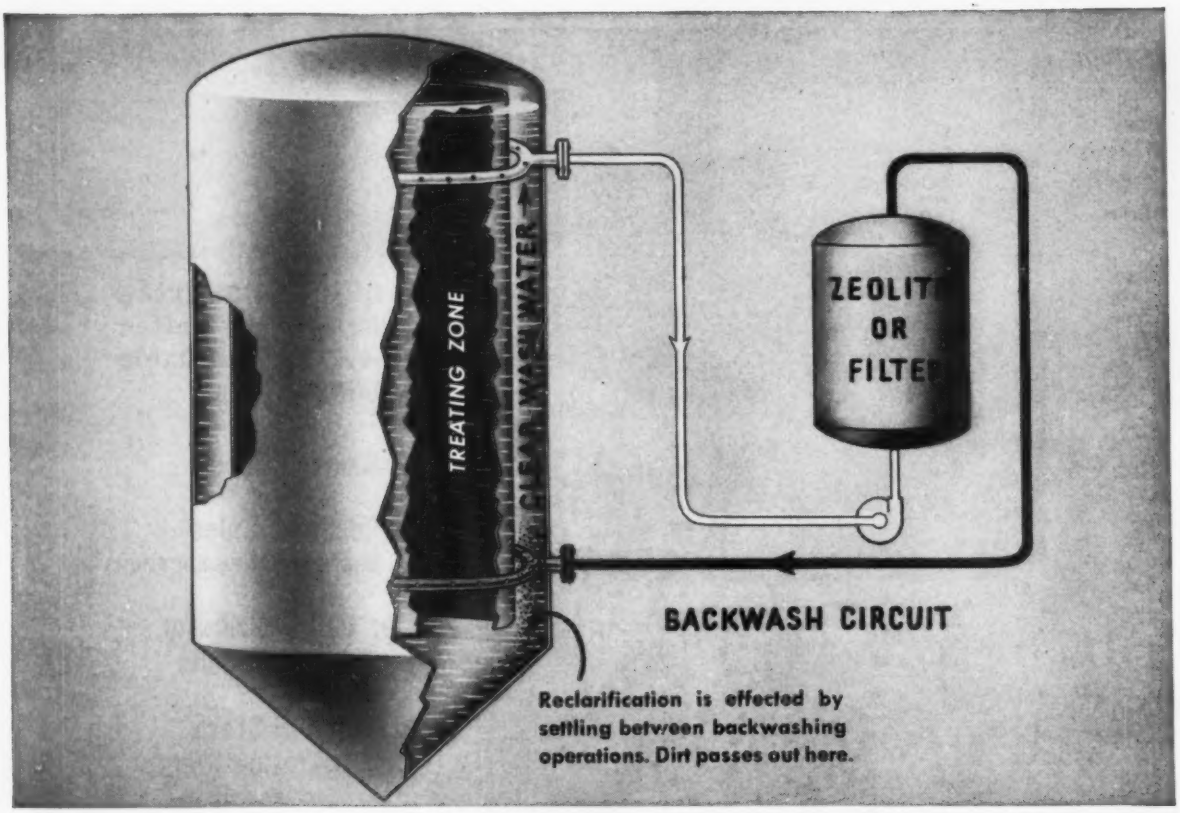
General Cable is an institution that stands for nation-wide service points, strategically located . . . Field Offices to render on-the-spot service . . . Teamed with important supply houses to put General Cable products on a local delivery basis from local distributing points.

Whatever your electrical wire and cable need, whenever you need it, make "General Cable" a part of your product description.

One Source of Complete Supply
One Completeness of Service
One Standard of Quality

GENERAL CABLE
CORPORATION

Executive Offices: 420 Lexington Avenue, New York 17, N. Y. Sales Offices in Principal Cities in the United States.


TREATING ZONE
ZEOLITE OR FILTER
BACKWASH CIRCUIT
Reclarification is effected by settling between backwashing operations. Dirt passes out here.

BACKWASH FLOW CIRCUIT IN WORTHINGTON HOT-PROCESS SYSTEM shows how *independent* built-in, annular wash-water compartment* provides clean, hot, chemically inert water for backwashing and reclaims it without affecting operating velocities in treating zone, or subjecting hot zeolite to temperature changes. Backwashing is accomplished by recirculation of the clarified wash water.

*Reg. U.S. Pat. Off. 2,263,398

You can't wash clean with dirty water!

How Worthington Hot-Process Water-treating systems backwash with CLEAN, hot, chemically inert water

When you're considering hot-process water-treating systems with hot zeolite, filters, or both, *don't overlook backwashing facilities.*

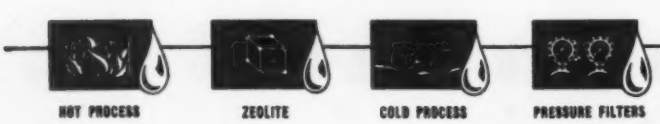
They must be well designed, or the system cannot give smooth, efficient, trouble-free performance. Worthington engineers recognized this fact when they designed their first hot-process system. Today, every Worthington standard Hot-Z or conventional system provides exclusive *independent* facilities for backwashing zeolite or filters with clean, hot, chemically inert water without disturbing the normal flow through the reaction bank.

Worthington water-treating specialists don't believe you can wash clean with dirty water.

This unique backwashing provision is just one of many Worthington patented features, but it alone will more than justify your selection of a Worthington system for hot-processing boiler feedwater in your plant.

If you have a problem, whether it involves filtration, precipitation, or zeolite treatment, Worthington specialists will be happy to study your water-treating problem and recommend the proper system. Just write, stating service conditions in detail, to Worthington Corporation, Water Treating Division, Harrison, N. J.

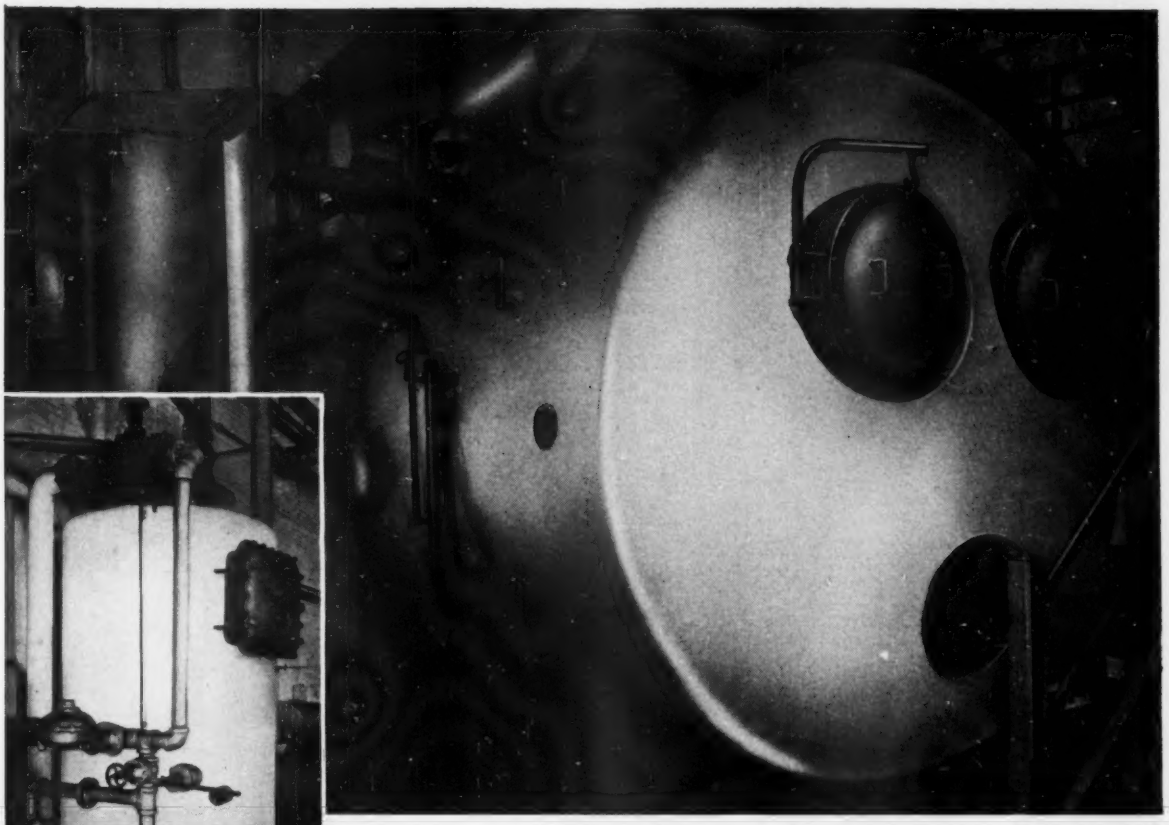
J.3.1

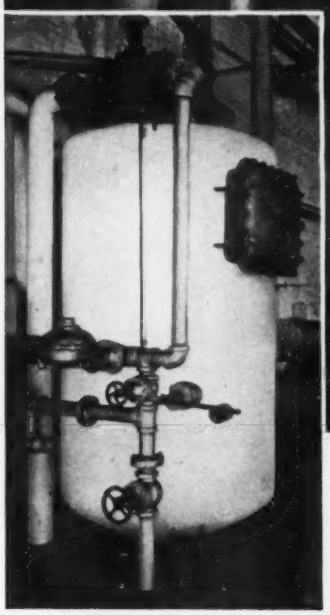


Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON

Water Conditioning





A Big Help

on small—as well as big—deaeration jobs

Small deaerators are big business at Worthington! That's why the plant with small-capacity requirements will benefit by getting acquainted with the complete range of Worthington deaerating equipment.

Worthington Gives You All Types, All Sizes

Worthington deaerating heaters and deaerators are built in sizes to handle from a few thousand pounds an hour to over a million. They are tailor-made to fit the particular requirements of each job. Special designs are available for operation with scale-forming water.

Both tray and steam-jet types are made—with external surface-type vent condensers or internal direct-contact vent condensing. They can be furnished for any practical operating pressure—constant or variable—or for vacuum operation.

With a complete range of sizes and types at their fingertips, Worthington engineers can competently recommend the design best suited to *your* requirements.

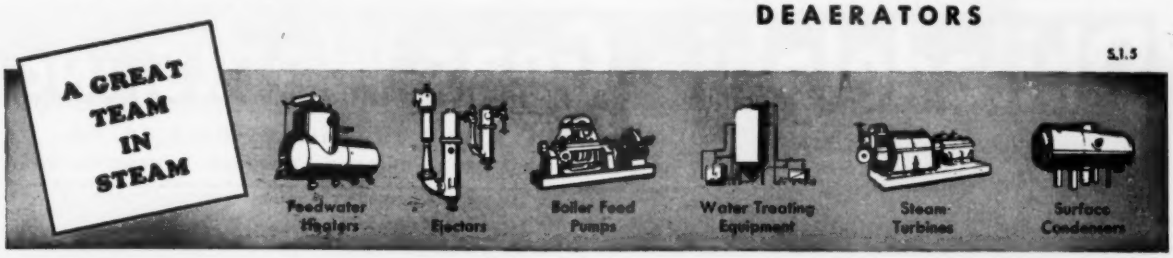
Remember, too, Worthington designs are backed by over 50 years experience in the design and manufacture of direct contact feedwater heaters and over 100 years experience in hydraulic machinery.

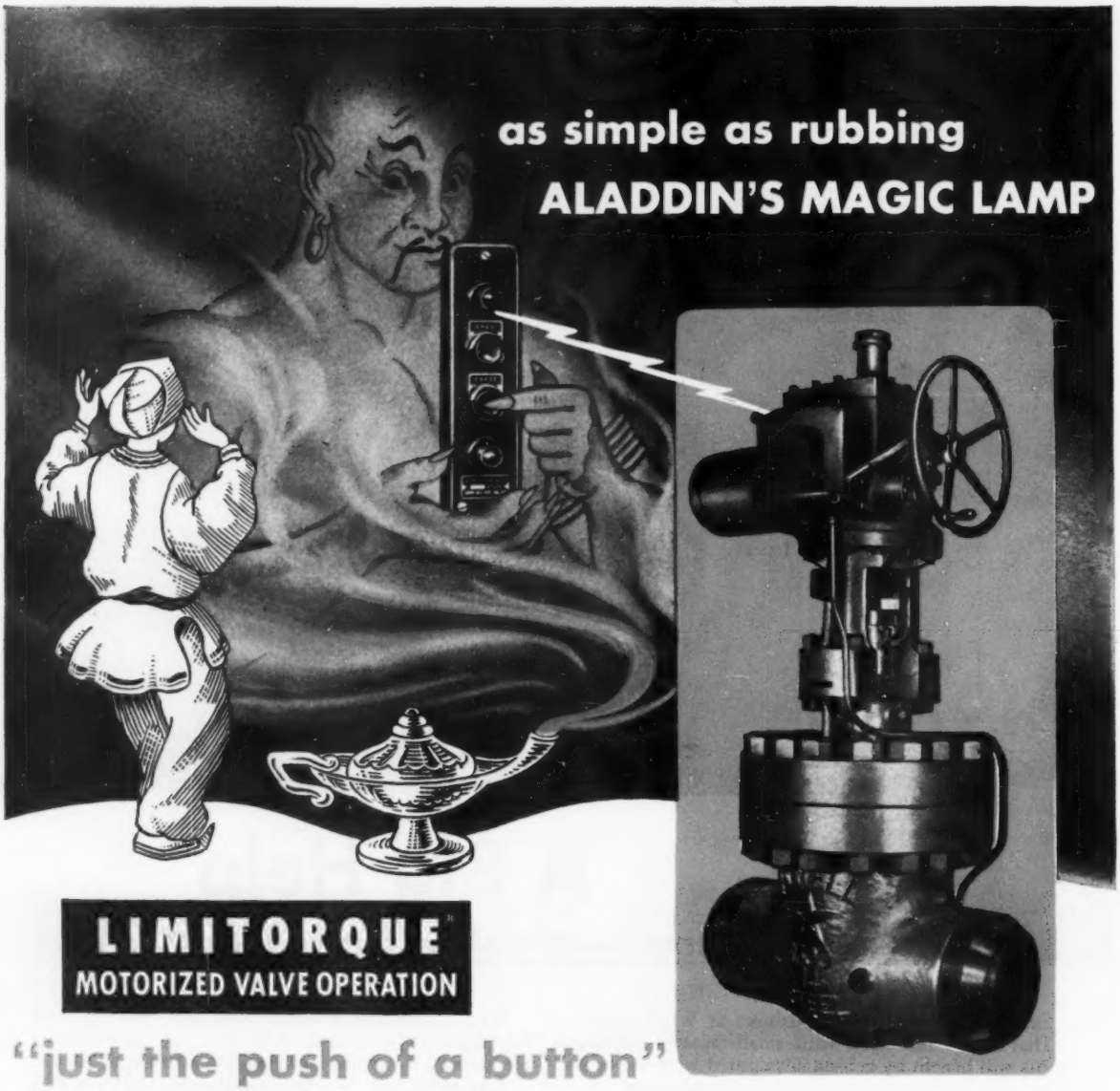
Send your water treating problem to Worthington Corporation, Steam Power Division, Harrison, N. J.

WORTHINGTON

DEAERATORS

S.I.5





LIMITORQUE
MOTORIZED VALVE OPERATION

"just the push of a button"

Hardly less magical than the rubbing of a lamp, accompanied by a few mysterious incantations—is the opening and closing of huge valves under high pressures, in remote places, or even miles away—by the MERE PUSH OF A BUTTON. Yet, that is the magic of *Limitorque* Valve Operation—safe, sure, dependable, accurate—and without the possibility of any damage to valve stem, seat, or disc.

Limitorque, is truly Valve Operation Magic—and that is why far more *Limitorque* Valve Operators are used today, than all others combined. Be convinced, send for our latest catalog L-50.

Philadelphia Gear Works, INC.

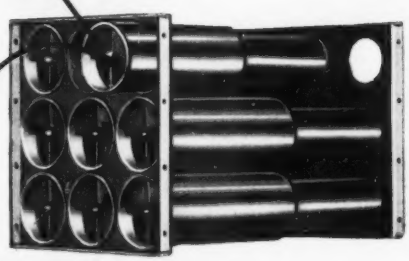
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

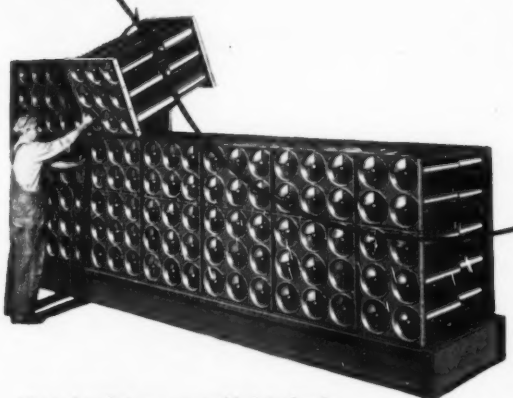
American Blower . . . a time-honored name in air handling

Beginning of the end of a fly ash problem

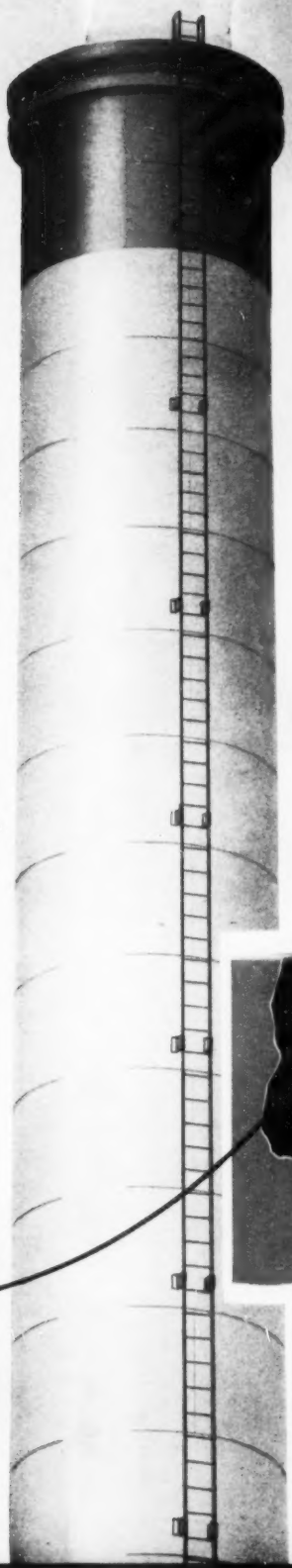
This is a tube assembly, consisting of an inlet tube, a spinner element and a smaller outlet tube.



Tube assemblies are grouped at the factory into convenient bundles, like the one above.



These bundles are assembled in banks to complete construction of the primary unit as your plant requirements dictate.



American Blower Type ST Precipitators are built up in banks, assembled at the factory, shipped in sections.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

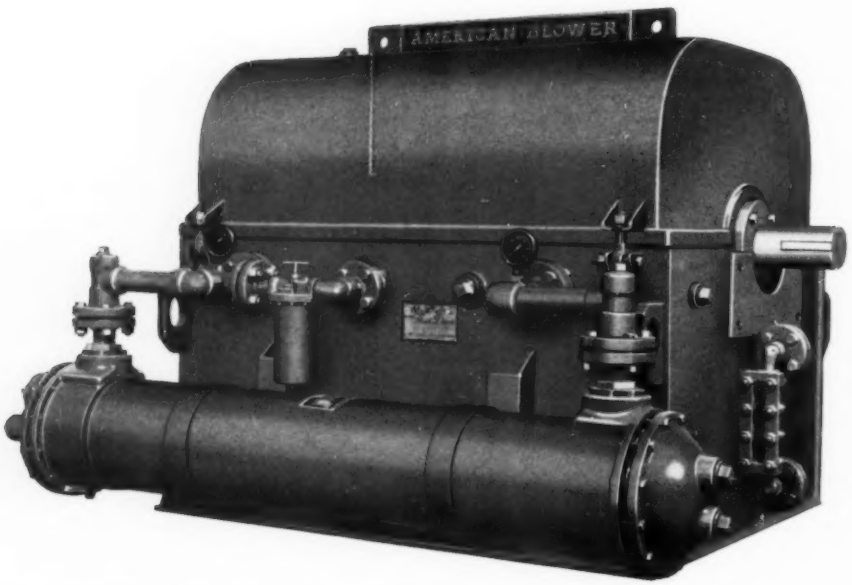
Fly ash ends here

SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR-TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS HEATER

American Blower . . . a time-honored name in power plant equipment



American Blower Class 4 Gyrol Fluid Drive

Memo to Power Plant Men —

You'll save power, eliminate starting shocks, get stable control over the entire range with American Blower Gyrol Fluid Drives on your forced and induced draft fans. It's the best means we know of to get stepless control from approximately 98% motor speed down to 20% with a simple constant speed driving motor.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

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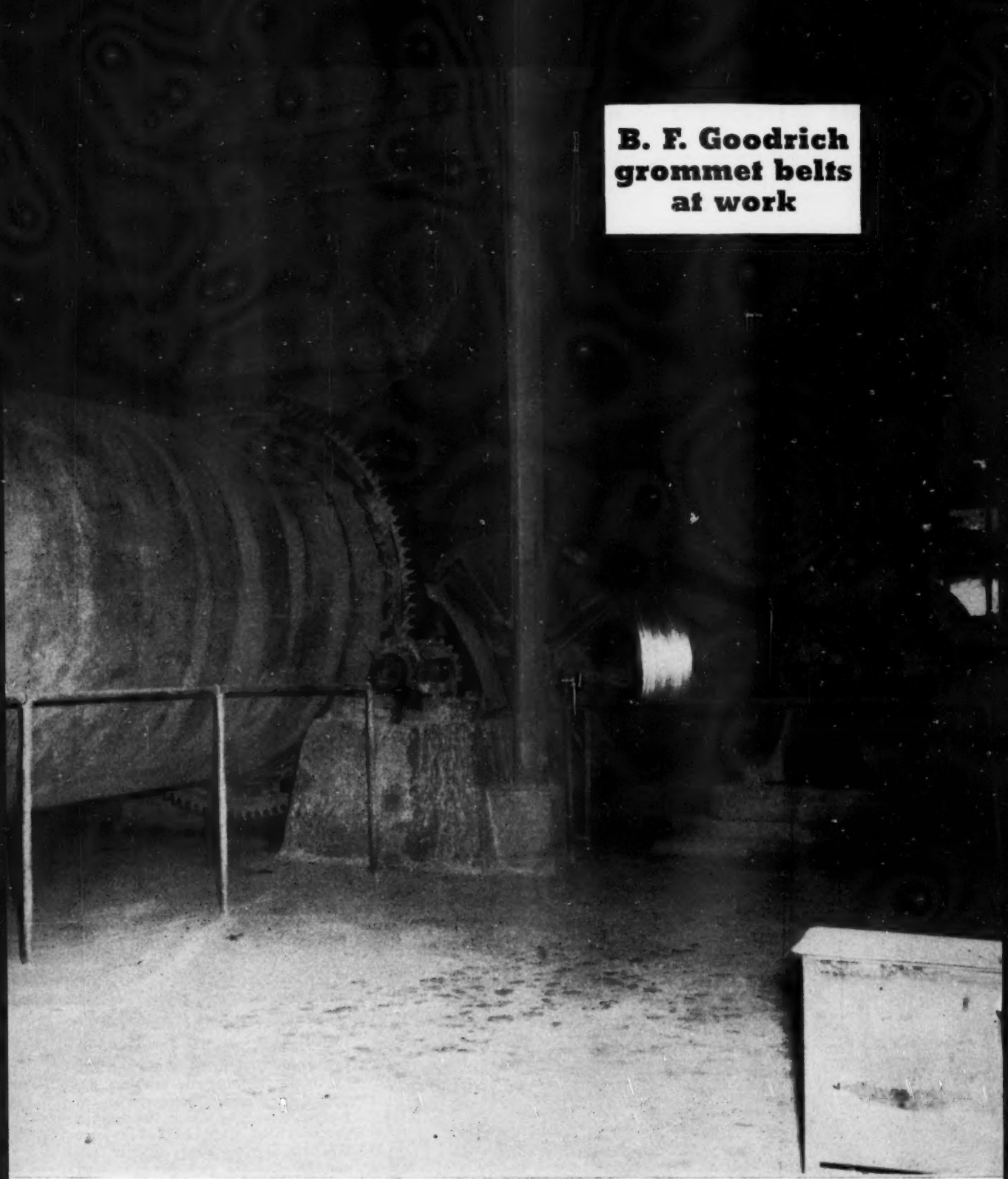
Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS HEATER

B. F. Goodrich grommet belts at work



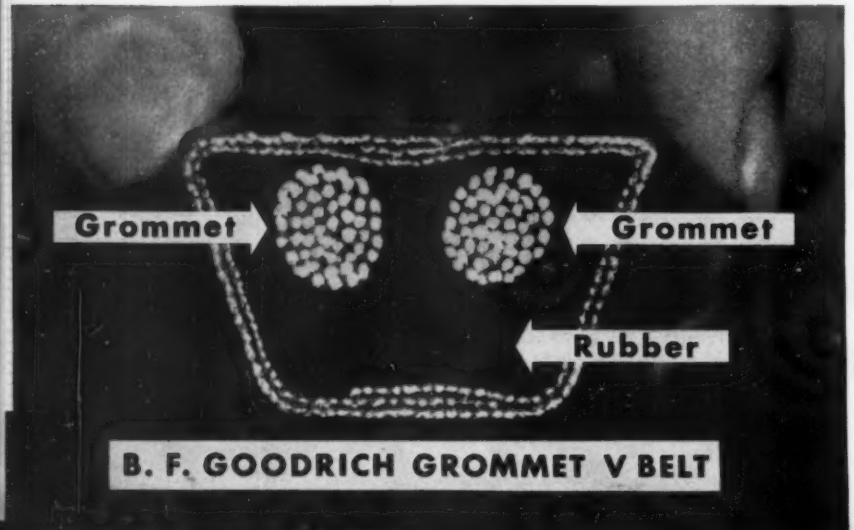
Steel balls inside tube grind gypsum into powder for plaster, just as pebbles inside chicken's gizzard pulverize food.

Steel gizzard makes plaster

This tube, loaded with steel balls and gypsum weighs almost 100 tons. When the tube revolves it does a beautiful job of grinding the gypsum into powder for plaster, but *keeping* it revolving was a major job. It is driven by V belts. Trying to get the weight turning sometimes snapped these belts like so many pieces of string. Belts wore out before their time. An entirely new kind of belt was needed. To find out how the problem was solved, see the following pages.

Steel gizzard (continued)

Power drain of motor here is so heavy, machine is run only at night as belts whirl tube shown on preceding page.



THE only thing the plant manager had to do to solve the problem described on preceding page was switch from ordinary V belts to B. F. Goodrich grommet belts. These belts *look* the same but, because of an entirely different construction principle, grommet belts stand more shocks and heavier loads than any other kind. The B. F. Goodrich belts had been installed five years when these pictures were taken and still look good for many years more.

20 to 50% longer life

Grommet V belts, made only by B. F. Goodrich, represent the only basic improvement since invention of the

V belt. Belts last 20 to 50% longer, depending on the service. (The more severe the service the greater the increase over ordinary belts.)

What is a grommet?

A grommet is like a giant cable except that it's endless—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All cords put to work

In ordinary belts under high tension the center cords "dish" and tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Each grommet and every part of a grommet carries its share of the load. Grommet V belts have no center cords — therefore much more strength in proportion to cord volume.

Better grip, less slip

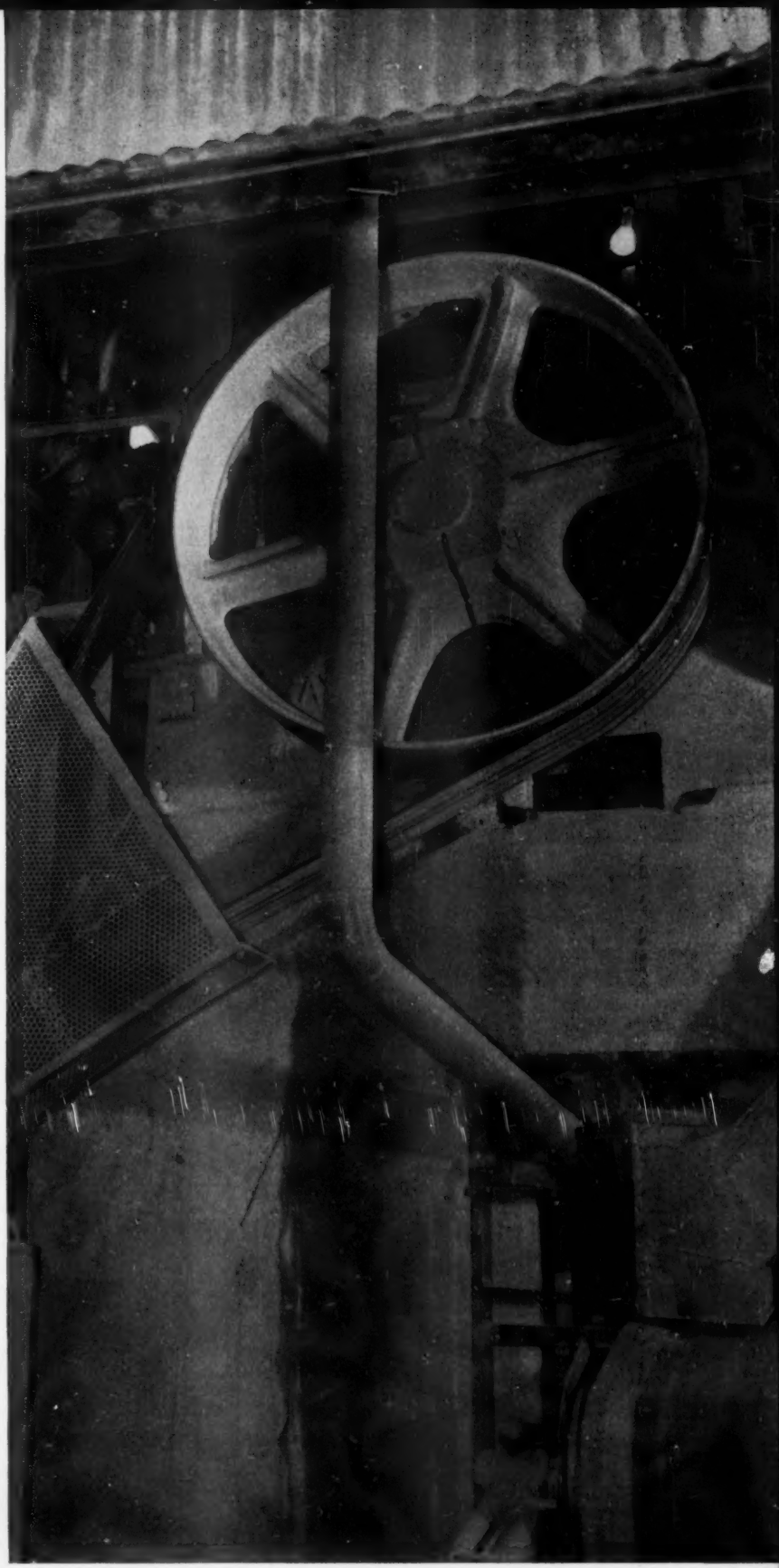
Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

They cost no more

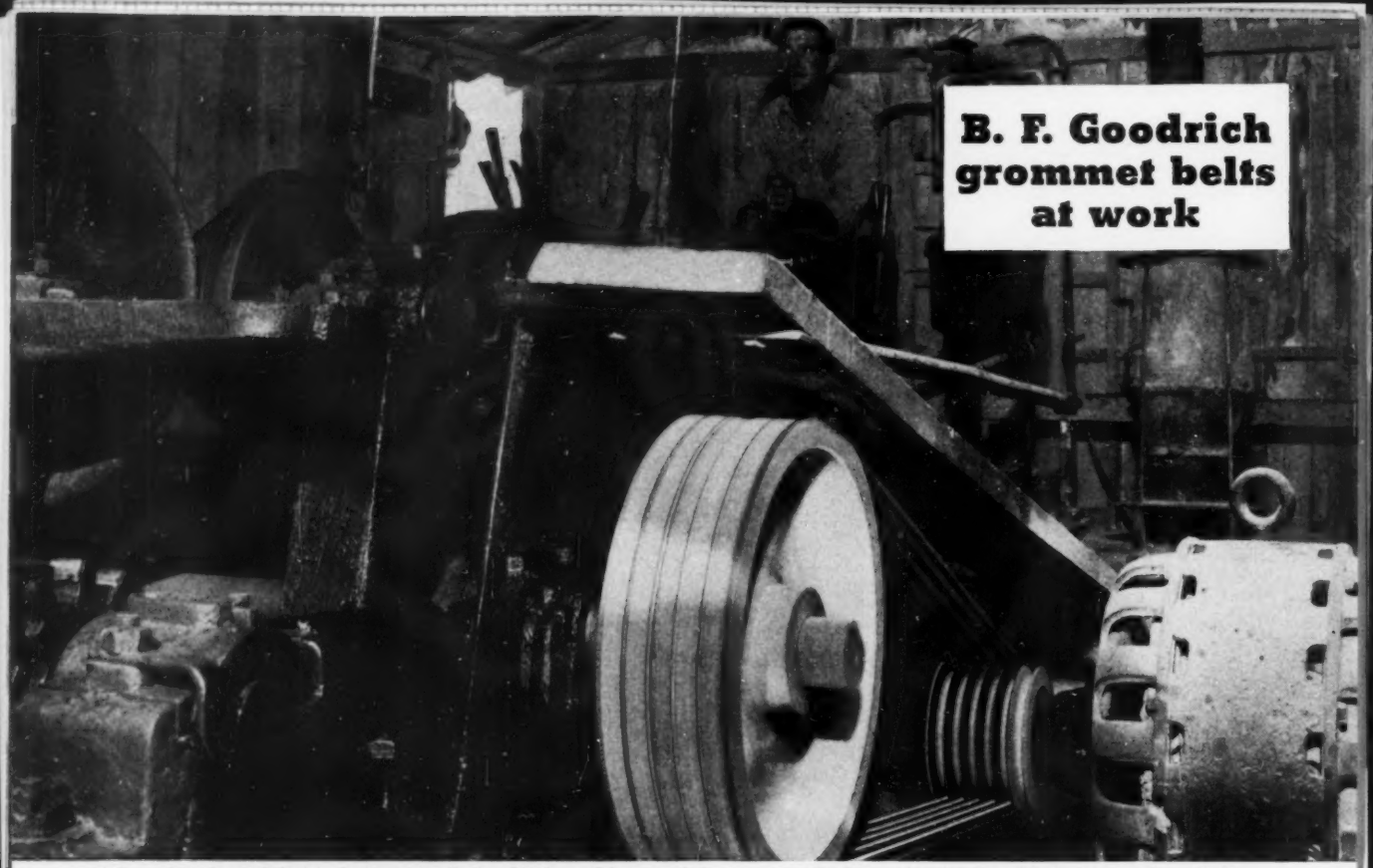
You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. Only B. F. Goodrich makes the grommet V belt.

Shock treatment

The jolting action of this rock crusher puts terrific shock and strain on the V belts. In addition to running 20 hours a day, seven days, the belts that drive the crusher are exposed to abrasive rock dust. Engineers knew no ordinary belt could handle the job, so grommet V belts, developed by B. F. Goodrich to give belt users more for their money, were installed. Grommet belts are not only operating the crusher more efficiently and cutting maintenance costs, but they are also giving long life for this type of service—eight months when the picture was taken—and are still going strong.



Treatment for shock was success when grommet V belts prescribed.



When this derrick hoisted giant-sized chunks of marble out of the quarry, the heavy loads caused belts to stretch and slip.

50-ton air lift

That derrick operator has his eye on a 50-ton chunk of marble he's swinging through the air. A motor supplies the power for the weight-lifting act—with an assist by the rubber V belts which link motor to hoist.

Belts previously used gave trouble. The heavy loads caused stretching and slipping. But this problem was solved when a BFG distributor installed a set of grommet V belts. Grommet V belts are built to handle heavy loads, yet are more flexible so they don't slip or stretch as much as ordinary belts. In this case, they put an immediate stop to slipping, and provided more power to the hoist.

These typical examples (see preceding pages) tell you why B. F. Goodrich grommet belts are superior to ordinary V belts—prove they last 20 to 50% longer—yet cost no more.

The B. F. Goodrich Company
Department M-59
Akron, Ohio

☐ Send set of reports telling users' experiences and showing actual installations where grommet belts outlasted all others.

☐ Please have a BFG distributor call. I'd like to find how I can save money with grommet V belts.

Name_____

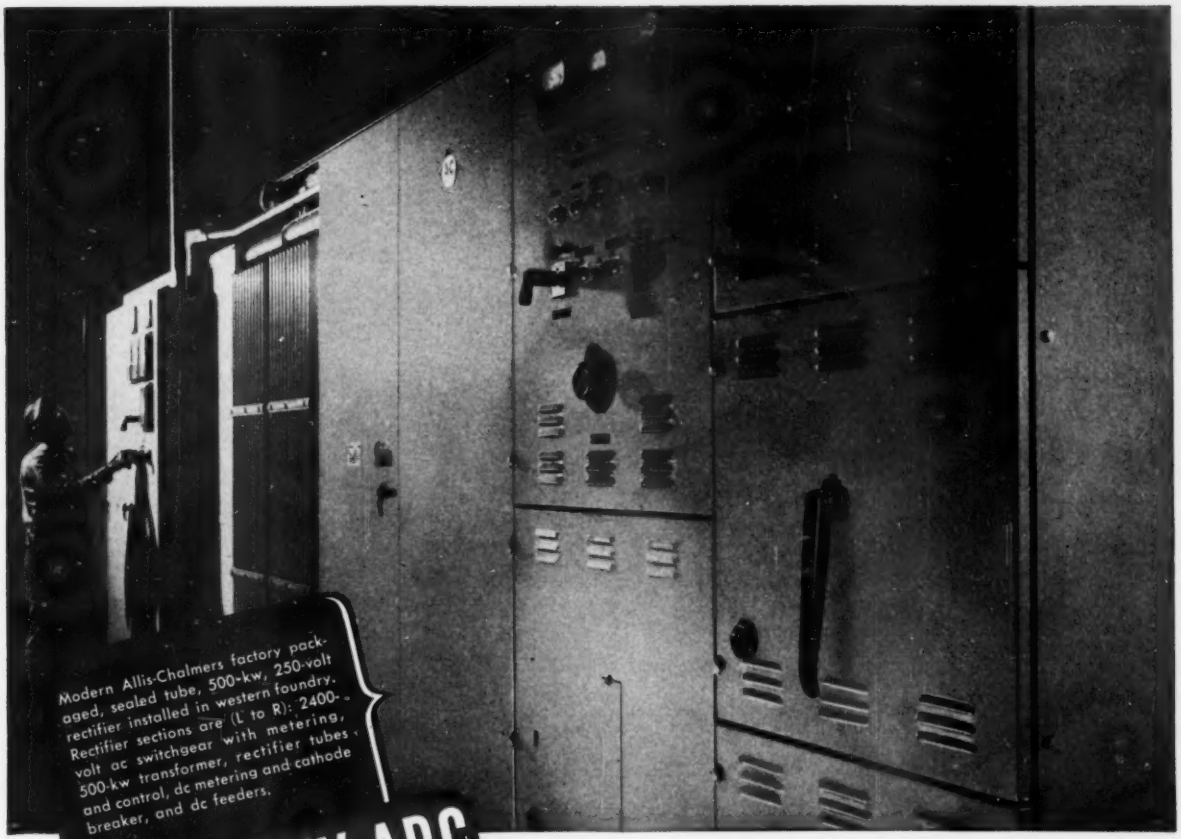
Firm Name_____

Address_____

City_____ Zone_____

State_____

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER



Modern Allis-Chalmers factory packaged, sealed tube, 500-kw, 250-volt rectifier installed in western foundry. Rectifier sections are (L to R): 2400-volt ac switchgear with metering, 500-kw transformer, rectifier tubes and control, dc metering and cathode breaker, and dc feeders.

MERCURY ARC RECTIFIERS For Critical DC Service

Supply Power for Centrifugal Pipe Casting Machines at Western Foundry

PRODUCTION UNIFORMITY DEPENDS on accurately regulated dc supply at the U. S. Pipe & Foundry Company, Decoto, California.

Variable speed dc drives on the centrifugal pipe casting machines *must* start quickly and accelerate at a *controlled* rate to distribute the melt uniformly throughout the mold before it hardens. *Reliability* is also vital since dc powers not only the casting machines but also the cranes transporting the molten metal.

The Allis-Chalmers 500-kw sealed tube mercury arc rectifier seen here was recently installed to meet these critical requirements. This rectifier combines the good regulation and low maintenance characteristics of the mercury arc rectifier with the following *exclusive* A-C refinements:

- **Fixed excitation anode** that doesn't contact mercury and is independent of level, turbulence or impurities.
- **Continuous excitation** — pilot arc always present, eliminating need for continuous and synchronized re-ignition. Rectifier will ride through severe ac voltage disturbances.
- **Grid phase control** — in cleaner region near anode, where ion density is lowest.
- **Internal cooling system** — high heat transfer with seamless tube cooling coil located within the rectifier.
- **Arcover-free tube** — eliminates danger of arcing-over to tube by insulating entire arc path.
- **Enameled anode seals** — multi-layer fused vitreous construction provides high strength, trouble-free seal.

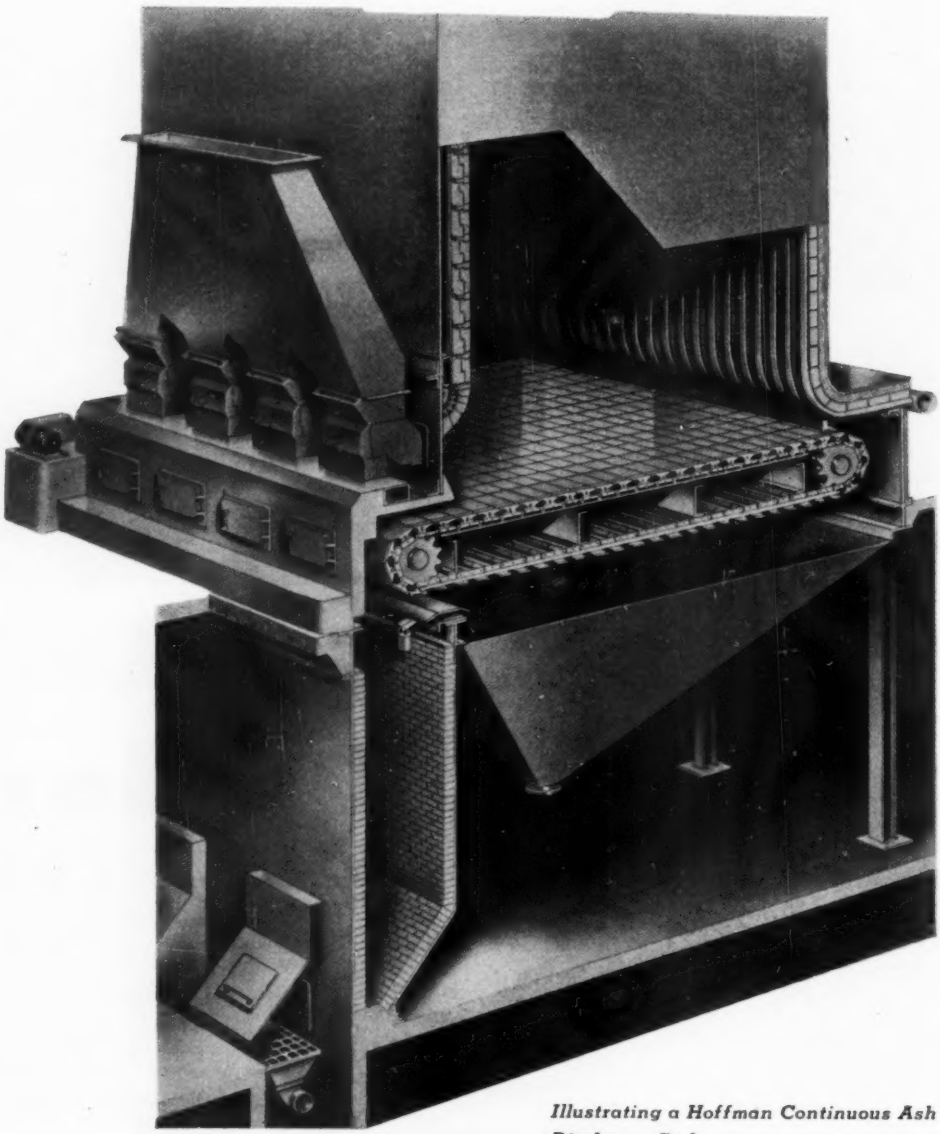
Allis-Chalmers sealed tube rectifiers are supplied in ratings from 200 kw at 250 volts to 1000 kw at 600 volts. When planning a rectifier installation of *any* size, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis.

A-3855

ALLIS-CHALMERS

Our Engineers Introduced Mercury Arc Rectifiers to U. S. Industry

FIRST
Firite
SPREADER



Illustrating a Hoffman Continuous Ash Discharge Stoker

HOFFMAN COMBUSTION ENGINEERING COMPANY

HOFFMAN Spreader Stokers

The HOFFMAN ENGINEER In Your community is a man trained in our engineering, service and installation departments. His job is to serve customers and prospective buyers—to bring to consulting engineers the basic features of Hoffman stokers and keep them informed of research developments—cooperating in selective buying.

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General Offices: **Marquette Bldg. Detroit 26, Mich.**

Works: **Fairmont, W. Va., and Detroit, Mich.**

Ready FOR ANY FUEL JOB

There's never any need for compromising on the fuel properties you require for your particular combustion job, when you use Beacon Coal. You'll find, in this comprehensive line, a fuel that's exactly suited to each application: domestic hand and stoker fired; commercial hand or stoker fired; general industrial; electric utilities; railroad; steamship bunker; coke and gas plants; and special uses. Mine locations and shipping facilities, as shown on the chart, permit the most advantageous distribution. And finally, the conveniently located sales offices bring the able services of Beacon representatives within easy reach.

NAME OF COAL	CHARACTER	MINE
Sonman	Central Pennsylvania Low Volatile	Sonman
Indian Creek	Central Pennsylvania Medium Volatile	Melcroft
Federal	Northern West Virginia	Federal #1
Bergoo		Bergoo #2
		Bergoo #4
		Bergoo #6
Bolair		Bolair
Eccles	Southern West Virginia Low Volatile	Eccles #5
		Eccles #6
New River		Helen #9
		Stotesbury #8
		Stotesbury #11
Pocahontas		Keystone
		Maitland
Beards Fork	Southern West Virginia and Eastern Kentucky High Volatile	Beards Fork
		Page
		Kopperston #1
Nos Gas		Kopperston #2
		Wharton #1
Wharton		Wharton #2
Weeksbury		Weeksbury

Want a copy of this chart for your fuel file?

If you'd like one of these ready-reference charts for file . . . just drop a line to the nearest office.

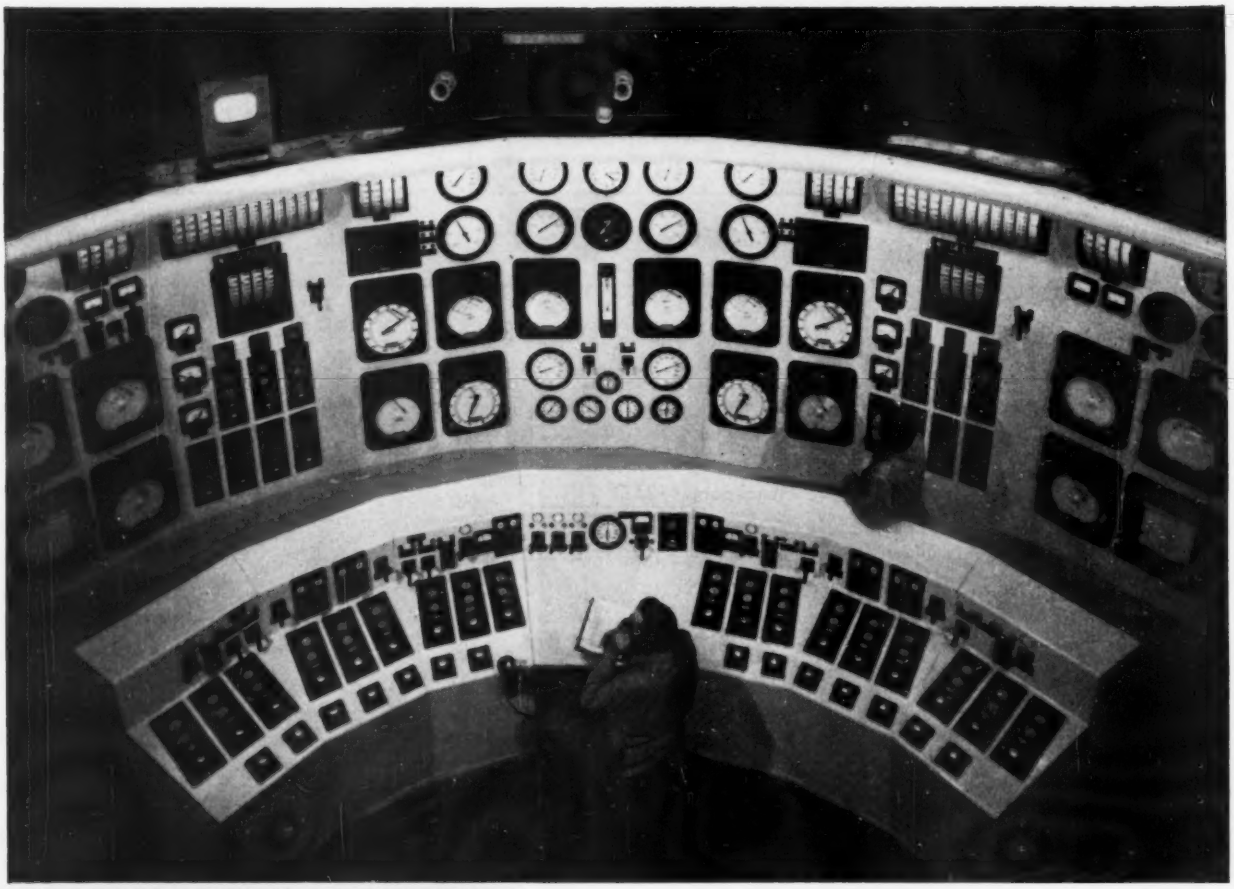
EASTERN GAS AND FUEL ASSOCIATES

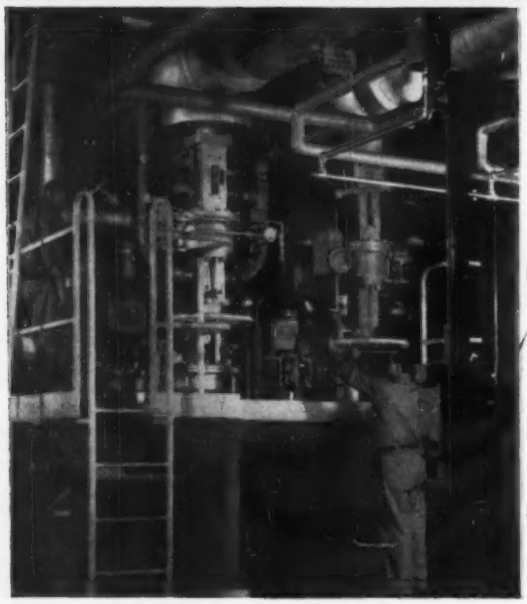
EASTERN

This convenient Reference Chart shows why!

SEAM	COUNTY & STATE	RAILROAD	DIS-TRICT	SIZES MADE	DAILY PROD. TONS	NAME OF COAL
"E"	Cambria (Pa.)	Penna.	1	Egg; Stoker; M/R; N&S; Slack	2500	So[illegible]an
"B" or Miller	Fayette (Pa.)	B & O	1	M/R; N&S; Slack	1200	Indi[illegible]Creek
Pittsburgh	Marion (W. Va.)	Monongahela; B&O	3	Lump; Egg; Nut; Stoker; M/R; N&S; Slack	10,000	Fe[illegible]al
Sewell	Webster (W. Va.)	Western Maryland	3	M/R	1500	
Sewell	Webster (W. Va.)	Western Maryland	3	Lump; Egg; Nut; Jr. Egg; M/R; N&S	1600	Be[illegible]o
Sewell	Webster (W. Va.)	B & O	3	M/R	1000	
Fire Creek	Webster (W. Va.)	B & O	3	Egg; Nut; M/R; N&S	2000	Bo[illegible]r
Beckley	Raleigh (W. Va.)	C&O; Virginian	7	Egg; Stove; Nut; N&S; Slack	2500	Be[illegible]y
Sewell	Raleigh (W. Va.)	C&O; Virginian	7	M/R; N&S; Slack	1000	Se[illegible]ll
Pocahontas #3	Raleigh (W. Va.)	C&O; Virginian	7	Stove; Nut; N&S; Slack	2500	
Pocahontas #4	Raleigh (W. Va.)	C&O; Virginian	7	Stoker; M/R; Slack	2000	New[illegible]ver
Pocahontas #4	Raleigh (W. Va.)	Virginian	7	M/R; Slack	1800	
Pocahontas #3	McDowell (W. Va.)	N & W	7	Egg; Stove; Nut; Stoker; M/R; N&S; Slack	5000	Poca[illegible]tas
Pocahontas #4	McDowell (W. Va.)	N & W	7	Stoker; M/R; Slack	1500	
Eagle	Fayette (W. Va.)	Virginian	7	M/R; N&S	1500	
Eagle	Fayette (W. Va.)	Virginian	7	M/R; N&S	1000	Ea[illegible]e
Eagle	Wyoming (W. Va.)	Virginian	8	M/R; N&S; Slack	3500	
Campbells Creek	Wyoming (W. Va.)	Virginian	8	M/R; N&S; Slack	4000	No. [illegible]as
Hernshaw	Boone (W. Va.)	C & O	8	Lump; Egg; M/R; N&S	3500	Wh[illegible]on
Hernshaw	Boone (W. Va.)	C & O	8	M/R; N&S	3000	
Elkhorn #3	Floyd (Ky.)	C & O	8	Block; Egg; M/R; N&S; Slack	1000	Wee[illegible]bury

GAS AND FUEL ASSOCIATES





PRESSURE REDUCING STATIONS in the plant are controlled automatically or manually, as desired. The two stations shown include Republic pressure reducing valves which are controlled from a master pressure regulator. Desuperheater stations, controls for feed-water pumps and discharge valves, and flow meters were also furnished by Republic for this modern power plant.

FOUR CYCLONES AT HIS FINGER-TIPS

Two 400,000 lbs./hr. boilers fired by four cyclone furnaces are checked and controlled from this central control point. Republic sub-panels on the control bench board are provided for transferring between automatic and manual operation. Also included are Republic biasing sub-panels for adjusting coal-air ratio, primary-secondary air, cyclone ratio and boiler rating.

They're Harnessing Cyclones....

with REPUBLIC *Automatic* COMBUSTION CONTROL

At a major chemical plant, the first 100% cyclone-fired industrial power plant in the country is being controlled for maximum combustion efficiency by Republic combustion controls. The plant produces 800,000 lbs. of steam per hr. at 1250 psi and 830° F. Steam is supplied to both chemical processes and to a 30,000 kw double-extraction turbine generator.

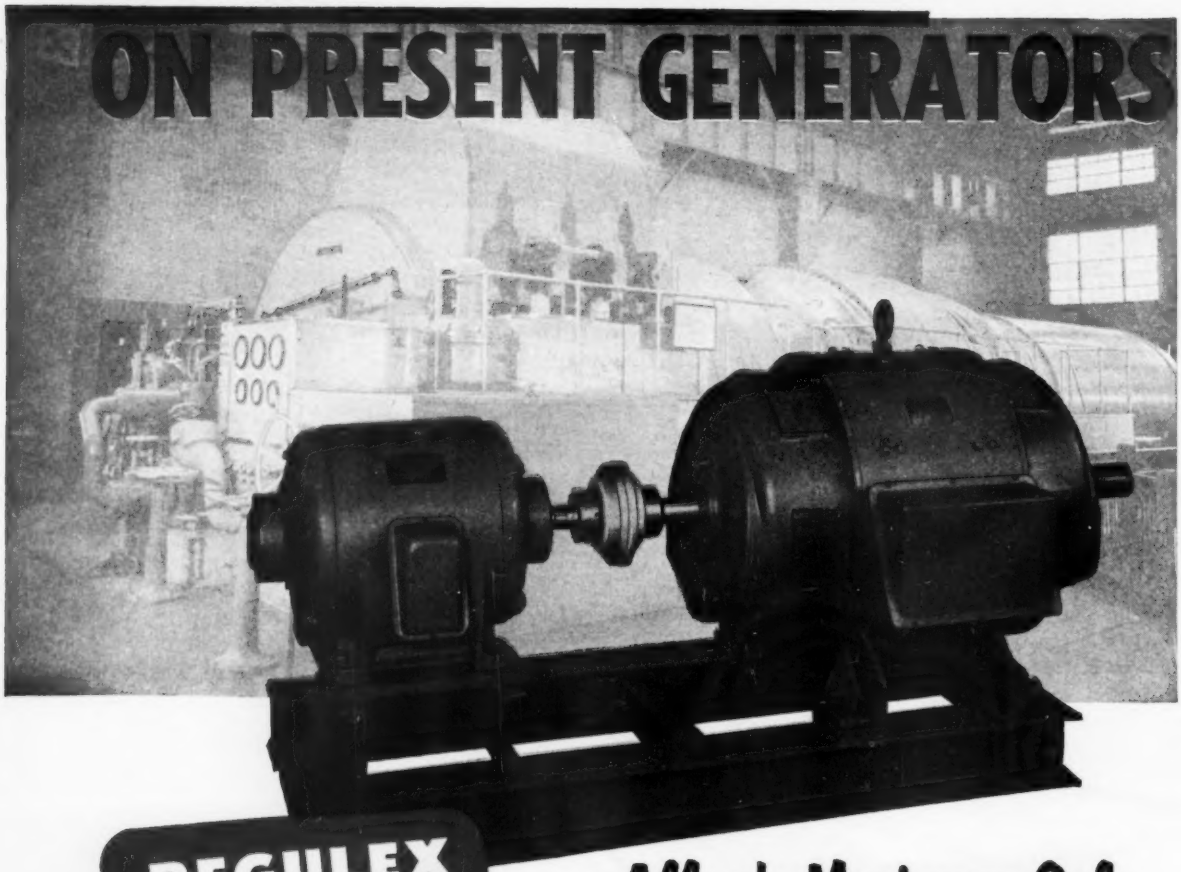
This cyclone-fired plant serves as *additional proof* that Republic combustion control systems can be adapted for *any* type of fuel firing. There are Republic combustion control systems for all sizes and types of boilers, all arrangements of draft equipment and for all load conditions. There's an experienced engineering staff* to help you get the combustion control system that best fits *your* needs.

For full information, write for Data Book S-21 or contact your nearby Republic field engineer.

*For more than 37 years, Republic has *specialized* in the design and manufacture of combustion control systems for all sizes of power generating stations.

REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY ● CHICAGO 47, ILLINOIS

MEET NEW DEMANDS ON PRESENT GENERATORS



Affords Maximum Safe Kilowatt Output at Any Power Factor Loading

IF GROWING PAINS are taxing your plant productivity . . . if ever-increasing demands require closer regulation for your present generating equipment, consider the new efficiency gained by installing a *Regulex* voltage regulator.

Automatic minimum excitation provided by the *Regulex* voltage regulator permits generator operation close to the stability limit . . . much closer than manual operation allows. The sensitivity and exceptional response of the *Regulex* voltage regulator and associated equipment establish and maintain a safe ratio between generator load and field current . . . increase operating limits at any given power factor load . . . assure the best reactive kva division. This means maximum kilowatt output — more power to sell from your present capacity.

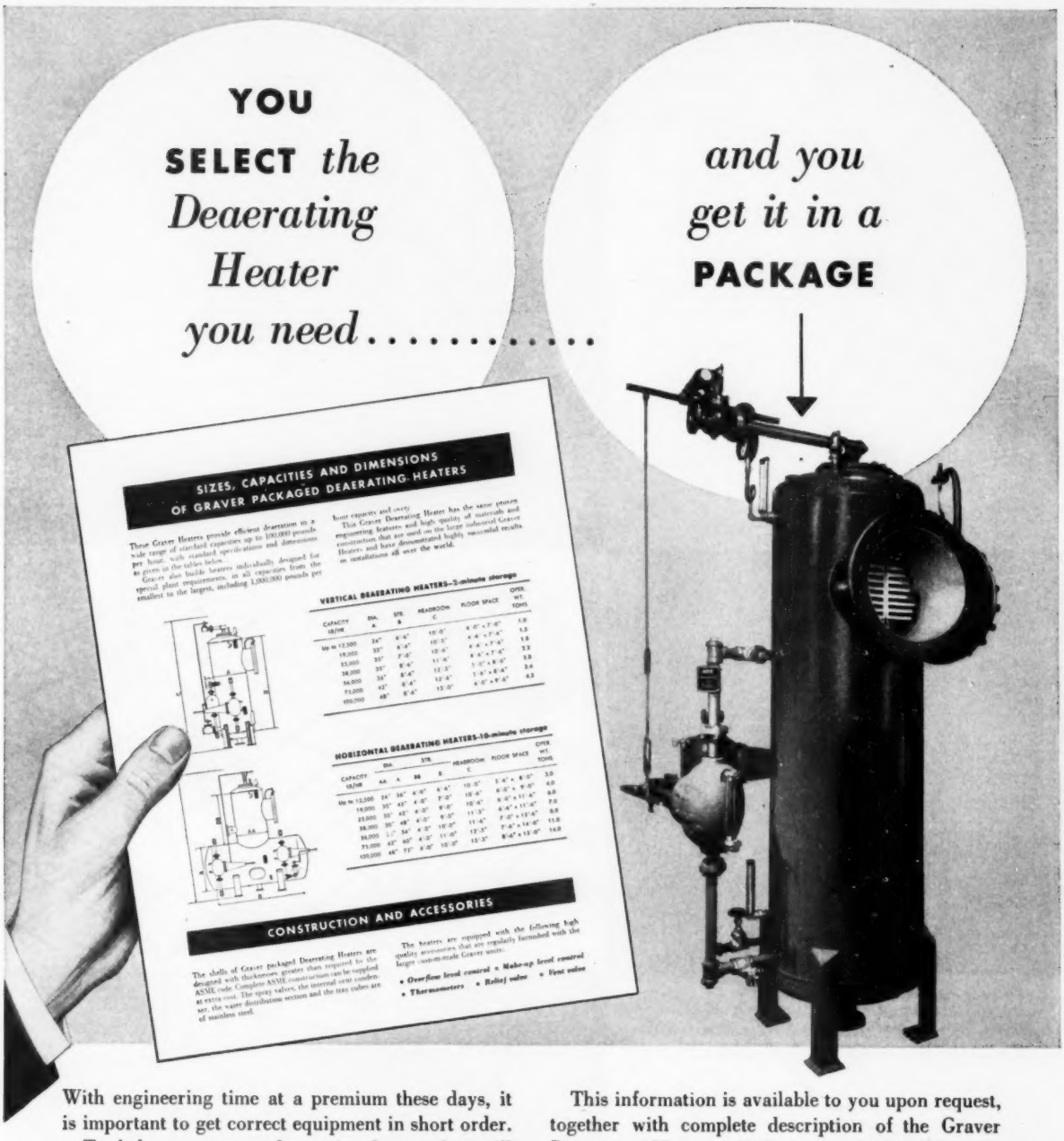
Get all the facts from your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4018

Regulex is an Allis-Chalmers trademark.

ALLIS-CHALMERS

YOU SELECT *the Deaerating Heater you need.....*

and you get it in a **PACKAGE**


SIZES, CAPACITIES AND DIMENSIONS
OF GRAVER PACKAGED DEAERATING HEATERS
These Graver Heaters provide efficient deaeration in a wide range of standard capacities up to 100,000 pounds per hour, with standard specifications and dimensions as given in the tables below.
Graver also builds heaters individually designed for special plant requirements, in all capacities from the smallest to the largest, including 1,000,000 pounds per hour capacity and over.
This Graver Deaerating Heater has the same proven engineering features and high quality of materials and construction that are used on the large industrial Graver Heaters and have demonstrated highly successful results on installations all over the world.
VERTICAL DEAERATING HEATERS—3-minute storage
HORIZONTAL DEAERATING HEATERS—10-minute storage
CONSTRUCTION AND ACCESSORIES
The shells of Graver packaged Deaerating Heaters are designed with thicknesses greater than required by the ASME code. Complete ASME construction can be supplied at extra cost. The spray valves, the internal vent condenser, the water distributing vacuum and the tray cubes are of stainless steel.
The heaters are equipped with the following high quality accessories that are regularly furnished with the larger custom-made Graver units:
• Overflow level control • Make-up level control
• Thermometers • Relief valve • Vent valve

With engineering time at a premium these days, it is important to get correct equipment in short order.

To help you get a *deaerating heater* that will exactly meet your needs, Graver has developed charts and data sheets that give complete engineering, selection and dimensional information for a wide range of heater capacities.

This information is available to you upon request, together with complete description of the Graver Deaerating Heaters which are furnished as a package . . . with all internal parts, controls, valves and instruments you need for the installation. Your request for this information will not involve the slightest obligation on your part.

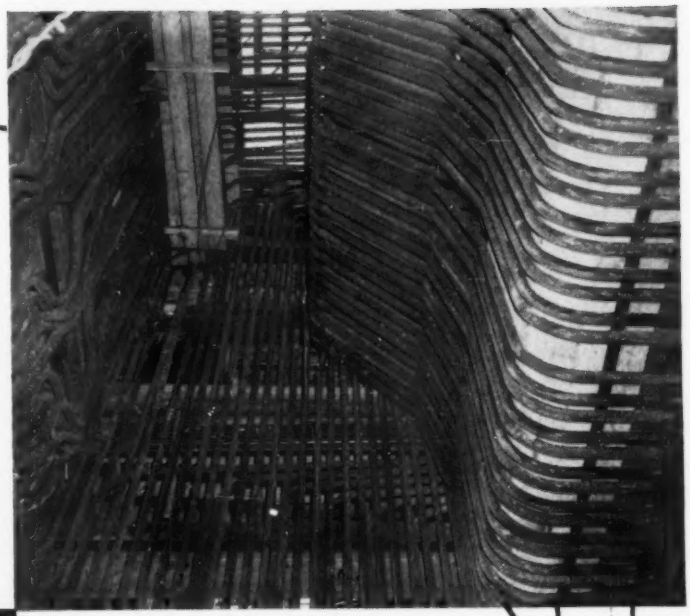
GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

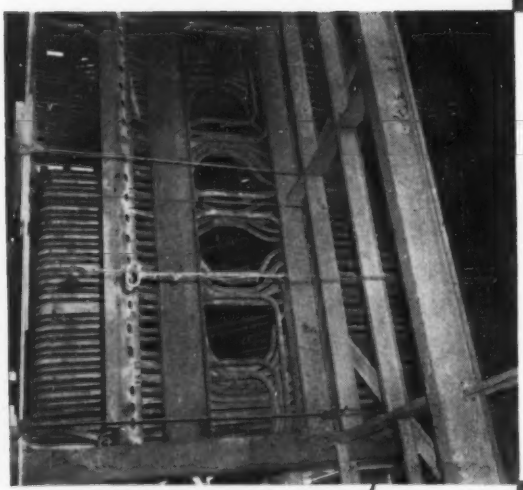
DEPT. P-PH, 216 WEST 14TH STREET, NEW YORK 11, N. Y.

In Canada: The Bird-Archer Co., Ltd., Cobourg, Ontario • In Mexico: Proveedores Tecnicos, S.A., Puebla 259, Mexico 7, D. F.

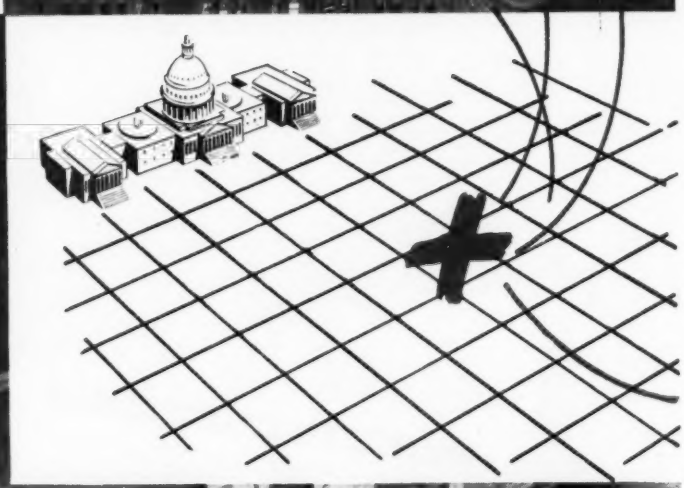
GRAVER Deaerating Heaters



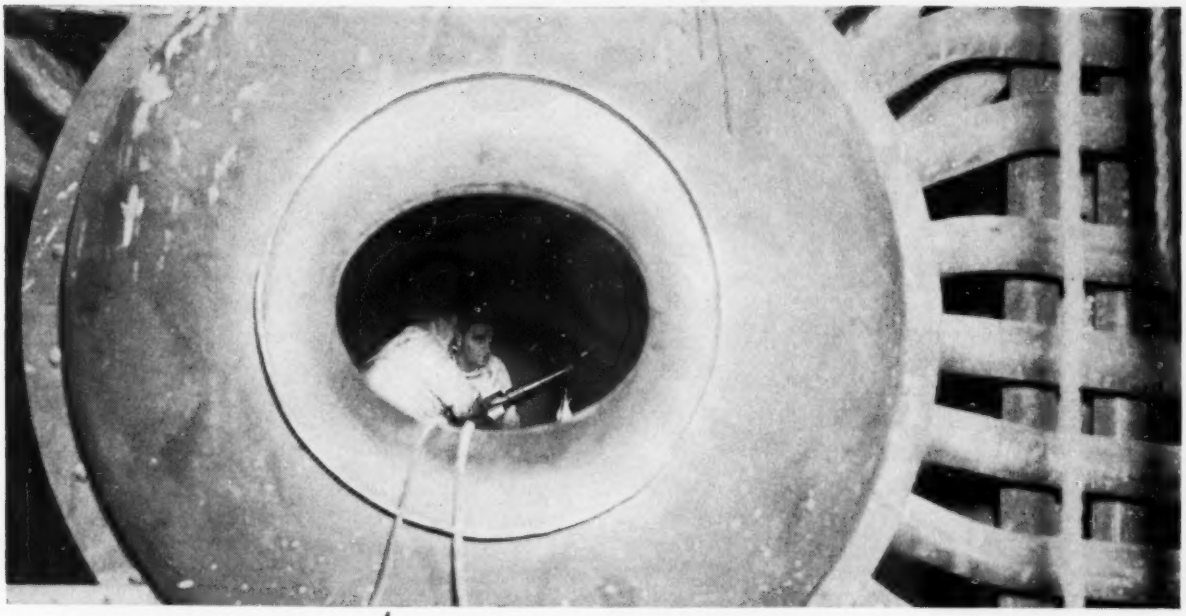
Three Wickes Boilers in Capitol Power Plant. Pressure: 450 psi. Capacity 110,000 pounds of steam per hour per boiler. Tubed with Republic ELECTRUNITE *Boiler Tubes.*



Fully-normalized, ductile Republic ELECTRUNITE *Boiler Tubes are readily bent to fit properly.*



Workmen like the way Republic ELECTRUNITE *Tubes roll-in . . . ductility and concentricity hold "weepers" to a minimum.*



Concentricity and uniform wall thickness assure snug fits into drum holes, makes Republic ELECTRUNITE *Tubes roll-in easier.*

STEAM

for the nation's Capitol . . .

made in Republic

ELECTRUNITE BOILER TUBES

• Republic ELECTRUNITE Boiler Tubes will make it warm for the 83rd Congress . . . and for many congresses to come.

The Capitol Power Plant in Washington is being completely modernized to provide steam at lower cost for the Capitol and other buildings in the Legislative Group, the Supreme Court Building, the Government Printing Office, and Washington City Post Office.

Wickes Boilers, erected by Larry Fyanes & Company, Washington, are tubed with Republic ELECTRUNITE Boiler Tubes. These high-quality steel boiler tubes provide uniform strength all around the tube, and from end to end. Full-normalizing provides uniform ductility to assure rapid roller-expansion. Uniform wall thickness makes for uniform concentricity and a snug fit of tubes into drum holes.

For new boilers or retubing jobs, specify Republic ELECTRUNITE Boiler Tubes for high strength and long life at low cost.

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
221 East 131st Street • Cleveland 8, Ohio

REPUBLIC STEEL

Republic ELECTRUNITE

BOILER, CONDENSER, AND HEAT EXCHANGER TUBES

...with TYCOL lubricants on hand!

Top this record! A well known utility company has operated a turbine for *almost 12 years* without an oil change or cleaning. At a rate of less than 10% "make-up" per year, Tycol Aturbrio has served the plant without malfunction – for years on end. And Tycol Aturbrio performance records show turbine after turbine running well over 100,000 hours without a change! That's *proven stability* ... further substantiated by the regular use of Aturbrio as an outstanding hydraulic oil. Full data on Aturbrio performance is available from your local Tide Water Associated office.

Over 300 Tycol industrial lubricants are at your disposal ... engineered to fit the job!

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C. • Pittsburgh
Philadelphia • Chicago • Detroit
Tulsa • Cleveland • San Francisco
Toronto, Canada

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N. Y.

REFINERS AND MARKETERS OF VEEDOL ... THE WORLD'S MOST FAMOUS MOTOR OIL

1878 75 1953
YEARS OF ELECTRICAL PROGRESS

Why rotors don't fail in G-E TRI CLAD motors

REG U.S. PAT OFF

G-E pioneering and research developed and produced this one piece cast-aluminum rotor winding, which has virtually eliminated rotor failures in Tri-Clad motors.

Rotor is indestructible in service because the bars, end rings, and fans are a "one-piece" casting. No brazed joints, no fabricated fans to come apart.

Rotor inertia is reduced by the lightness of the aluminum, thus raising efficiency and allowing easier starting, stopping and reversing.

Rotor efficiency is higher, operating losses reduced, as the result of a special chemical treatment.

The motor runs cooler because the integrally cast fans dissipate heat faster.

Operation is smooth and quiet due to the dynamic balancing of the rotor which also reduces bearing wear and material fatigue.

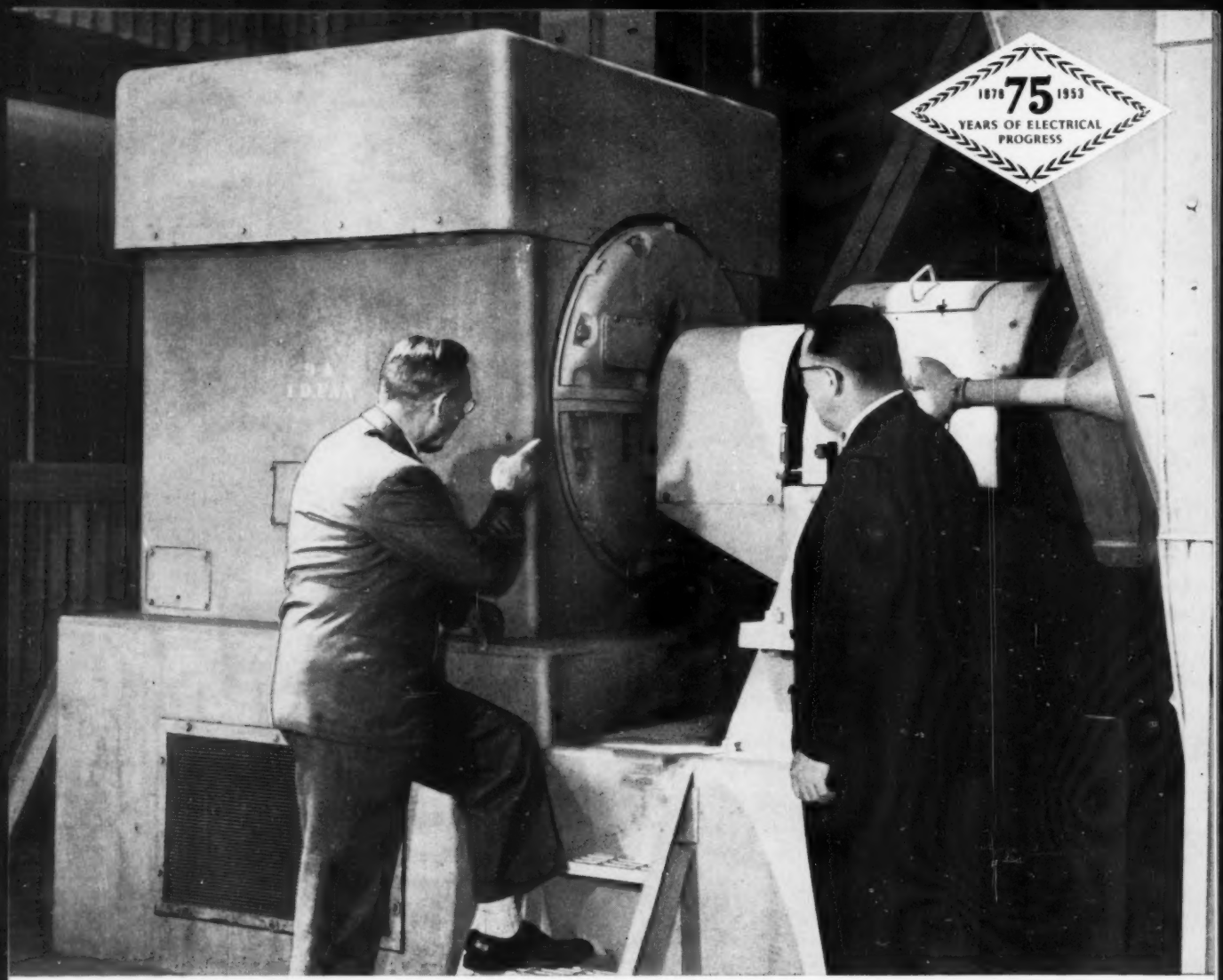
Long rotor life is one more reason why G-E Tri-Clad motors last longer — give you more reliable service and greater operating economy.

Order Tri-Clad motors today from your nearby G-E representative. You'll find popular models in stock. General Electric Co., Schenectady 5, N. Y.

752-20

You can put your confidence in—

GENERAL ELECTRIC



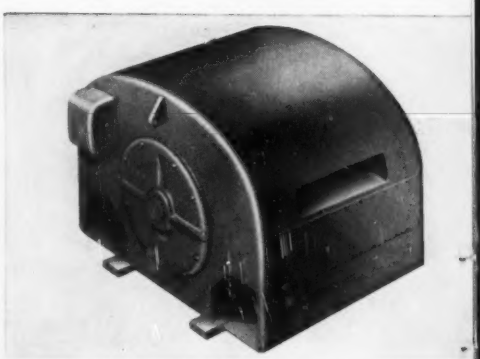
DALLAS POWER & LIGHT SAYS:

"G-E Weather-Protected Motors Give Us Dependable Service."

The Dallas Power & Light Company reports complete satisfaction with G.E.'s Weather-Protected Motors, used to drive induced draft fans. Developed by General Electric in 1949, they are the first successful outdoor ambient breathing motors—give outdoor protection at lowest possible cost.

General Electric's Weather-Protected Motors are available as Base Ventilated for high shaft applications and as Grade Mounted for low shaft applications. They have an effective low air velocity, air reversal system which practically eliminates moisture, dust, and other foreign materials from the cooling air.

For full data, contact your G-E Apparatus Sales Office or write for Bulletin 5810 to General Electric Co., Section 753-4, Schenectady 5, New York.



GRADE MOUNTED Weather-Protected Motors are designed so that driven rain, etc. blows *through* the air inlets—not into motor.

GENERAL ELECTRIC

MEMO TO COST-CONSCIOUS PUMP BUYERS:

The centrifugal pump to handle your job to satisfaction and at lowest power and upkeep cost is shown or described on this page.

"Buffalo"

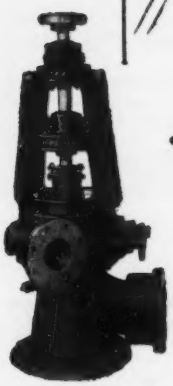
Pumps are not built to sell cheaply, but to operate cheaply. That is where pump savings are made. May we suggest that you and your staff write us for engineering bulletins on any pumps you need. Then look into the long-life features like oversize "Buffalo" bearings, shafts and stuffing boxes. See the accessibility of all parts, the high efficiency impeller design. You'll see why "Buffalo" Pumps save money!

BUFFALO PUMPS, INC.
488 BROADWAY BUFFALO, NEW YORK
Subsidiary of Buffalo Forge Co. Canada Pumps, Ltd., Kitchener, Ont.

...and DID YOU KNOW that you can get a "Buffalo" Fan of the exact size and type you want — for ventilation, blowing, exhausting, draft, air conditioning supply. "Buffalo" has been First For Fans for 75 years. You're safe in specifying "Buffalo" for your air handling needs!

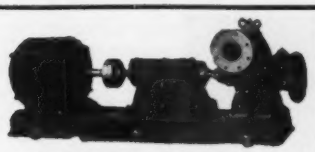
BUFFALO FORGE COMPANY
488 BROADWAY BUFFALO, N. Y.
Publishers of "Fan Engineering" Handbook
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

"Buffalo" PUMPS

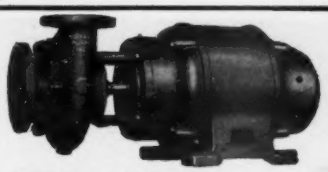


NON-CLOGGING SEWAGE PUMPS
For trouble-free sludge circulation, agitation and removal. Vertical or horizontal models. Request Bulletin 964-G.

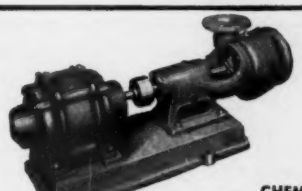
SUMP PUMPS
Complete units ready to install. No stuffing boxes required. Ball bearing thrust and enclosed shaft.
Bulletin 963-F.



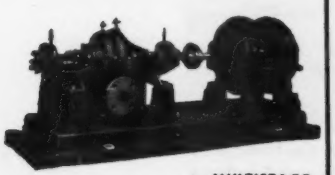
PAPER STOCK PUMPS
A pump for every liquid, consistency and head. Non-clogging enclosed impellers retain initial efficiency. Mill-proven for many years. Bulletin 953.



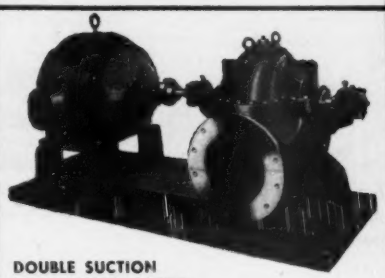
CLOSE-COUPLED PUMPS FOR ALLOY CONSTRUCTION
Compact, sturdy, easily installed. Shafts in permanent alignment. Bulletin 975.



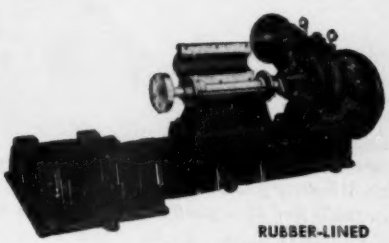
CHEMICAL SERVICE PUMPS
Suitable for construction in most machineable alloys. Full ball bearing, single suction. Bulletin 982.



MULTISTAGE CLEAR WATER PUMPS
for pressures up to 500 psi. Rugged, efficient, popular boiler feed pumps. Bulletin 980. "Buffalo" also manufactures automatic condensate pump and receiver units.



DOUBLE SUCTION CLEAR WATER PUMPS
are hydraulically balanced and of finest obtainable construction. Bulletin 955.



RUBBER-LINED
"Buffalo" Rubber-Lined Pumps handle a wide variety of acids, caustics and liquids containing abrasives. All pump parts contacting liquid are covered with the proper grade of rubber. Bulletin 953.

Widest choice . . . *for engineered instrumentation*

EACH of the thousands of industrial processes presents its own peculiar problems of measurement and control. Naturally, no single instrument can solve all of these varied problems. Serious compromises would have to be made in performance, convenience, and cost.

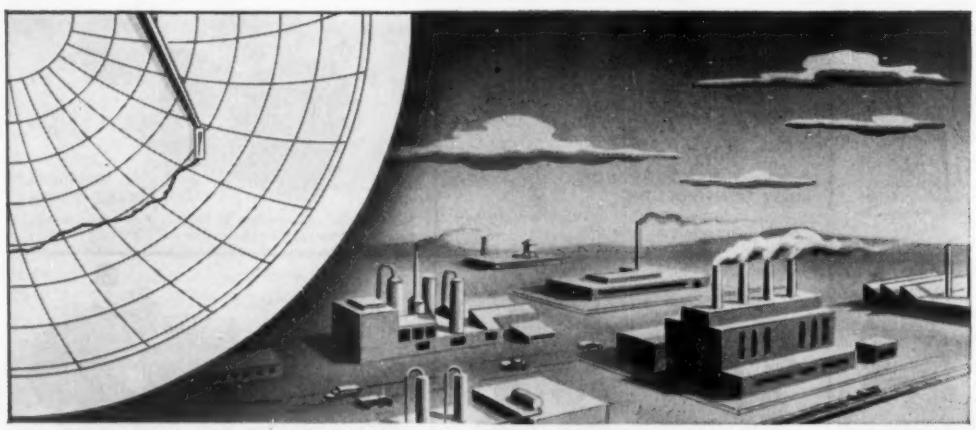
The many Honeywell primary elements, instruments, control systems, and final control elements constitute a uniquely complete family, covering practically the whole spectrum of industrial measurement and control. You can be sure that the combination selected for your job is recommended without bias, and with full consideration for every need of the application.

Included are *ElectroniK* instruments for indicating, recording and controlling a host of variables, in circular and strip chart models; *Tel-O-Set* miniature indicators, recorders and controllers; *Pyr-O-Vane* millivoltmeter controllers; square root and linear flow meters; thermometers; pressure gauges. Electric and pneumatic control systems range from the simplest to the most complex, including fully automatic program control. Primary elements include thermocouples, thermometer bulbs, *Radiamatic* elements, pH assemblies, conductivity cells, flow meter bodies and many others. For final control elements, there is a full range of motorized and diaphragm operated valves. Supplementing these are more than 7000 different non-indicating devices for controlling temperature, pressure, vacuum and other conditions.

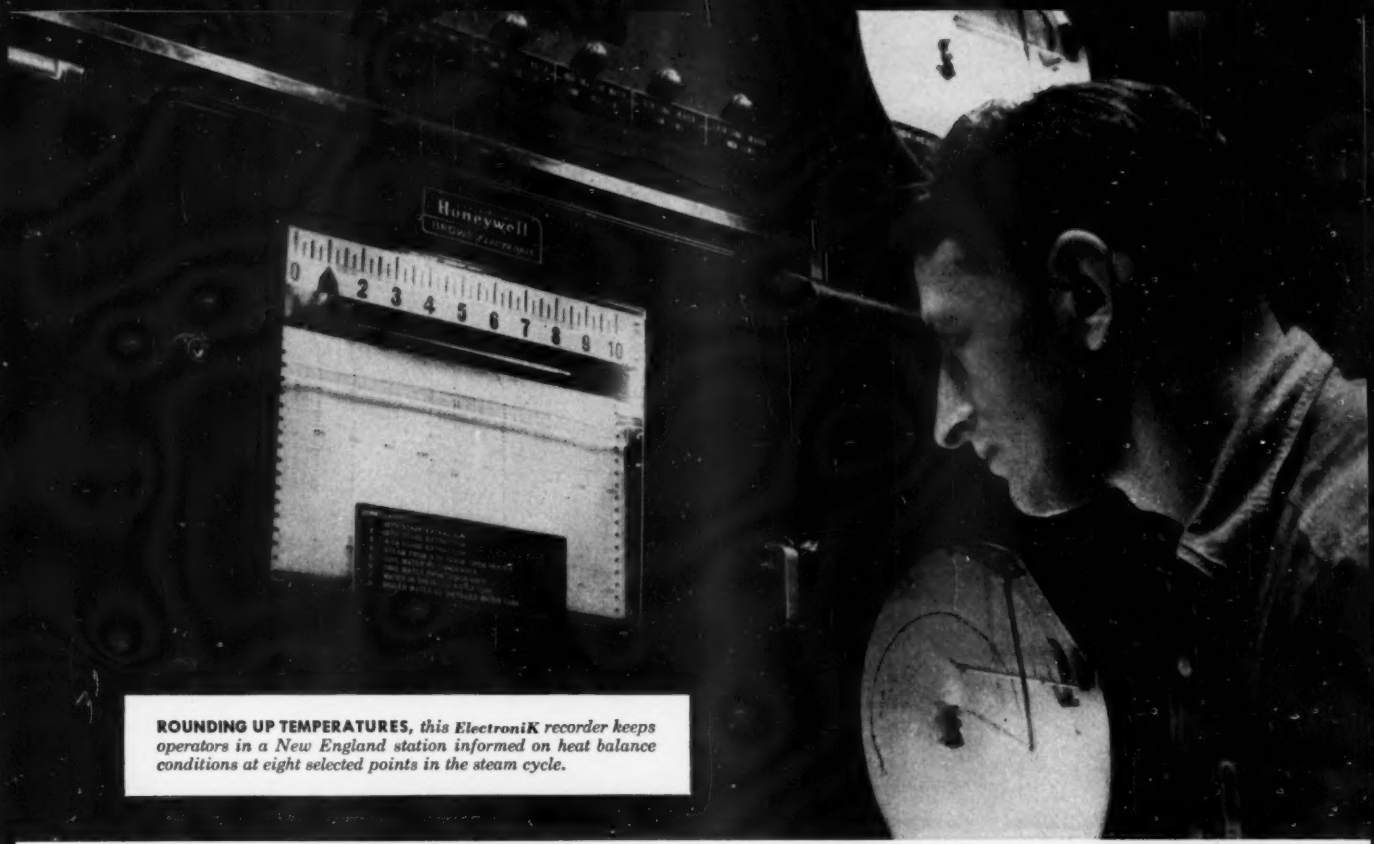
"Building block" approach

These are the building blocks of measurement and control. To combine them into systems custom-fitted to your process, Honeywell offers the know-how gained through years of experience in all branches of industry. Whether your process calls for a single instrument or a complete central control panel, you can be sure of getting the peak in performance and value . . . and the advantages of a single responsibility for the entire installation . . . when you specify *engineered instrumentation by Honeywell.*

Wherever *rely on*



COMPLETE COVERAGE *of industrial requirements for instrumentation is at your command in the Honeywell line. Whatever you need to measure or control . . . to any accuracy . . . with any of a variety of special features . . . you'll find Honeywell instruments offer the most efficient solution.*



ROUNDING UP TEMPERATURES, *this ElectroniK recorder keeps operators in a New England station informed on heat balance conditions at eight selected points in the steam cycle.*

measurement counts...

ElectroniK recorders

FOR ALL the vital measurements that are essential to power plant supervision, you'll get the most in performance with *ElectroniK* recorders. They have every feature that power engineers demand:

They're versatile: the same basic, industry-proved instrument is supplied for measuring temperature, frequency, power, flow, pressure, pH and conductivity. Single and multi-point models are available in a choice of printing speeds and chart speeds . . . readily equipped to operate signals and alarms.

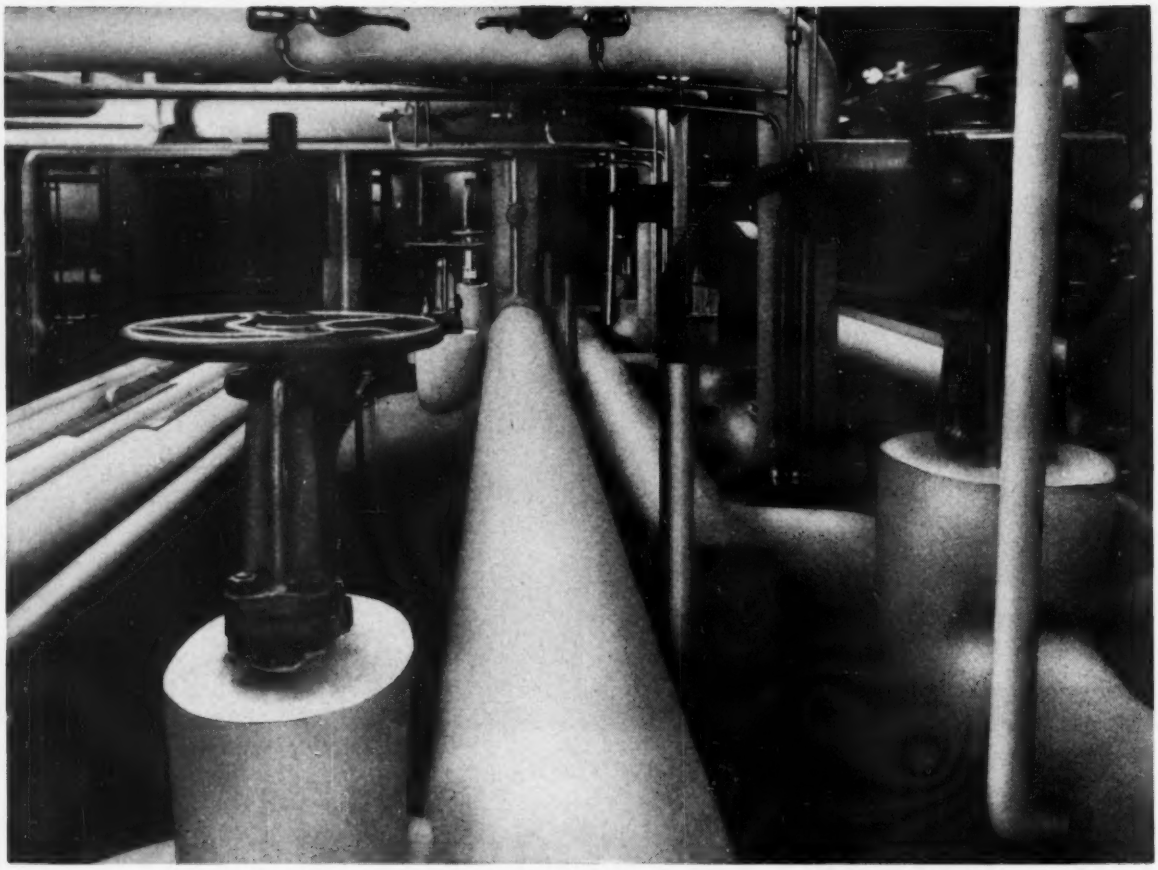
They're accurate: built of life-tested, service-proved components, such as hermetically sealed converters, high-torque balancing motors, and simplified amplifiers. They're unaffected by vibration, atmospheric humidity or dust. They have earned a reputation for staying on the job week after week . . . month after month . . . without interruption.

Behind these instruments stands the largest service organization of its kind, operating from more than 90 offices strategically located in the U. S., Canada, and throughout the world. Ask your local engineering representative for full facts . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Penna.

● **REFERENCE DATA:** Write for Catalog 90-2, "Supervisory Instruments for Power Generation."

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls



View of Pipe bay in large eastern utility plant, showing pipes insulated with K&M "Featherweight" 85% Magnesia.

FOR ECONOMY'S SAKE

Insulate with "Featherweight"

85% MAGNESIA

Save heat and you save money. Thousands of plants depend upon "Featherweight" 85% Magnesia to do just that. And no wonder!

"Featherweight" needs no introduction to thousands of users, many of whom first experienced its unusual qualities before this century began.

It is a superb insulation, low in thermal conductivity and not only effective on heated surfaces with temperatures up to 600° F., but when used in combination with K&M Hy-Temp Insulation, it is efficient up to 1900° F. This combination of double layers permits staggering all joints and eliminating heat loss through open joints when expansion occurs.

Keep this heat-saving, money-saving insulation in mind for applications in *your* company's plants. It will serve you well—always! For detailed information on "Featherweight" 85% Magnesia, see your local K&M distributor, who is an experienced applicator, or write directly to us.

Nature made asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA
In Canada: ATLAS ASBESTOS COMPANY, LTD., MONTREAL, TORONTO, WINNIPEG, and VANCOUVER

Eliminate the Danger of

INTERCRYSTALLINE CORROSION

ALLIS-CHALMERS WATER CONDITIONING
Equipment — Chemicals — Service

Photomicrograph of edge of crack caused by intercrystalline corrosion. U. S. Bureau of Mines detection unit (inset) tests for causes of intercrystalline corrosion.

Dangerous and costly cracks due to intercrystalline corrosion (embrittlement) will be no problem in your boilers if you have given careful consideration to the problem *in advance*. You can get the information you need to analyze your operations from Allis-Chalmers water conditioning Bulletin 45. It explains intercrystalline corrosion — the cause of embrittlement. It tells what tests are necessary to recognize this condition. And it discusses what you can do.

Get the Answer to Many Problems

Bulletin 45 is one of a series of Allis-Chalmers bulletins on water conditioning problems. Like all of these useful bulletins, it is based on the wide experience of Allis-Chalmers water conditioning men in handling water problems for nearly every industry. In addition, it is based on Allis-Chalmers long experience building turbines and power plant equipment.

Complete Service Available

Allis-Chalmers gives you complete water conditioning service. You can get analyses and reports on your problems. You can get the chemicals needed in all water treatments. And you can get the equipment for any system.

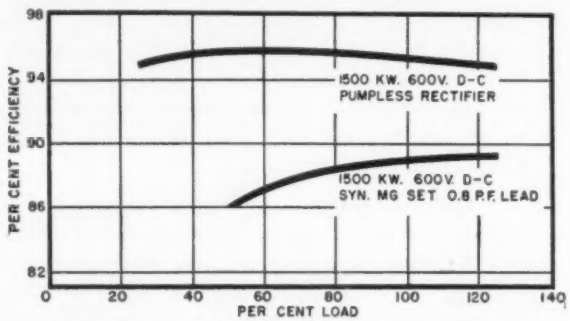
A-4014

For your copy of Bulletin 45 on intercrystalline corrosion, write Allis-Chalmers, Milwaukee 1, Wisconsin. Or better, call your nearby Allis-Chalmers district office and have an Allis-Chalmers representative consult with you on your water problems.

ALLIS-CHALMERS

New G-E PUMPLESS rectifiers... today's answer for d-c power needs

EVERY IGNITRON TANK after assembly is enclosed in a helium-filled bag—part of a rigid leak test prior to shipment.



EFFICIENCY CURVES for 600-volt d-c pumpless rectifier and corresponding MG set—show main reason you'll pay a smaller power bill.

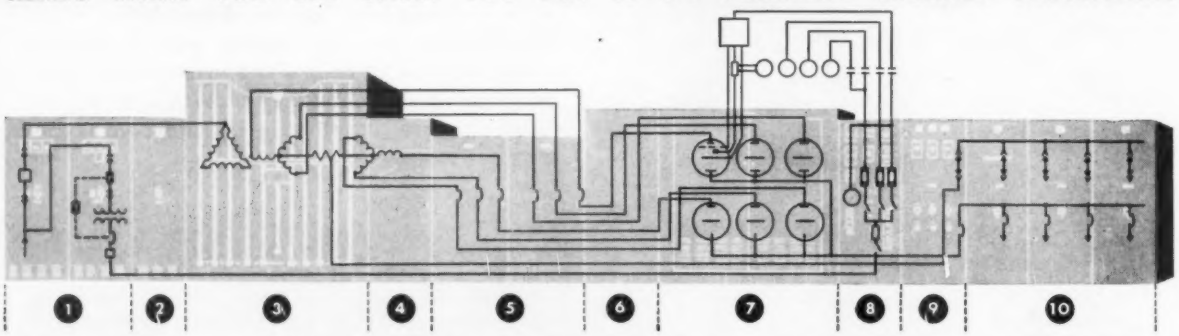
Sealed tank, design simplicity and 'packaged' installation assure low-cost conversion

General Electric Pumpless Rectifiers in your d-c unit substations give inexpensive d-c power by *eliminating the vacuum pumping system* found in conventional tank-type rectifiers . . . lowering installation, maintenance and power costs . . . and freeing valuable floor space for other use.

Featured in the rectifier itself is a semi-permanently sealed tank which holds its vacuum without pumping, yet does not have to be discarded in case of failure. In addition, the rectifier has been designed with a minimum of moving parts to assure greater operating efficiency . . . at lower operating cost. And since the rectifier is part of an integrated unit, there is no wiring to be done after delivery.

Complete information on G-E Pumpless Rectifiers is now available in a new bulletin. Easy-to-read, it graphically shows how you can apply low-cost d-c power conversion benefits in your own plant operation. For your copy, write for "Pumpless Rectifiers," GEA-5689. General Electric Co., Schenectady 5, New York. 883-1

HERE'S WHAT YOU GET WHEN YOU BUY A G-E PUMPLESS RECTIFIER SUBSTATION



1 A-C SWITCHGEAR SECTION
2 TRANSITION COMPARTMENT
3 TRANSFORMER SECTION
4 TRANSITION COMPARTMENT
5 ANODE BREAKER SECTION
6 TRANSITION COMPARTMENT
7 RECTIFIER SECTION
8 AUXILIARY CONTROL
9 CATHODE BREAKER
10 D-C FEEDER SECTION

GENERAL ELECTRIC

User Explains How Armstrong Unit Trapping Boosted Output:

Need for Investment in New Steam Equipment Eliminated by Only $550.00 in Steam Traps

THIS is a story about greatly increased efficiency in a laundry, but the principles involved apply to any plant using steam heated equipment.

In speaking of the benefits derived from Armstrong Unit Trapping, Earl Fast of Soft Water Laundry and Cleaners, Long Beach, California, said, *"It's like a man with dirty eyeglasses—he thinks he's seeing perfectly until he cleans the glasses and finds out what he has missed."*

Mr. Fast's plant modernized its entire return system in 24 hours, installing 71 Armstrong traps costing about $550, with these results:

1. Capacity of machines costing as much as $15,000 per unit increased to the extent that new machines are not now required.
2. Higher quality of ironing and finishing, with touch-up on shirts eliminated.
3. Worthwhile fuel savings.

"Our boiler was turning out plenty of steam," continued Mr. Fast, "but we weren't getting the benefit of it. The best power plant in the world is of no value if you don't use its produced steam to maximum efficiency."

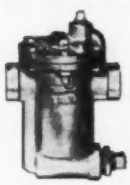
And there lies the case for Armstrong Unit Trapping, which discharges air and condensate as fast as it accumulates to keep steam heated equipment hot and producing at a peak rate. Your local Armstrong Representative will be glad to survey your condensate drainage system without obligation. Call him or write:

ARMSTRONG MACHINE WORKS

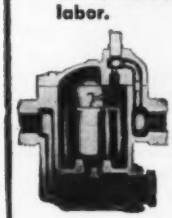
812 Maple Street • Three Rivers, Michigan

Traps with Built-in Strainers Cut Costs

Because the piping at Soft Water Laundry was old, the smallest-sized traps needed protection against dirt and scale. Armstrong No. 880 and 881 traps with built-in strainers were the logical answer because:



1. They cost less than a separate trap plus a strainer.
2. They eliminate external fittings and considerable installation labor.



Left—Cut-away view showing strainer screen at trap inlet. Strainer can be cleaned without removing or shutting off steam.

You always get more out of equipment when you use Armstrong "Unit Trapping"

FREE
44-PAGE STEAM TRAP BOOK
Gives Complete Information
MAIL TODAY!

FILL IN AND CLIP TO YOUR COMPANY LETTERHEAD

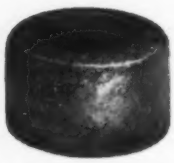
ARMSTRONG MACHINE WORKS
812 Maple Street, Three Rivers, Michigan
Please send me a Steam Trap Book.

Name .....

Title .....

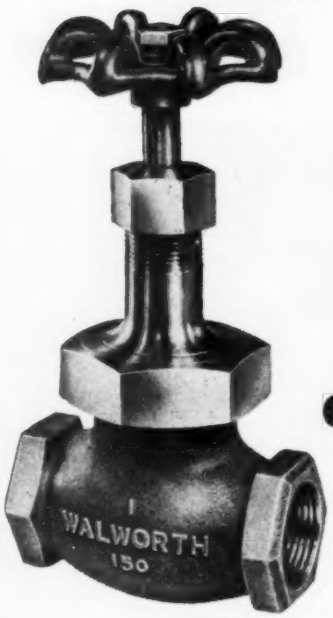
Toothed Lock Washer: Prevents loss of stem nut due to vibration, thereby holding the handwheel securely.

Newly Designed Handwheel: Air-cooled, finger grip handwheel affords sure grip even with greasy gloves.



Improved Packing: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure.

WALWORTH



IMPROVED
No. 95
BRONZE
GLOBE VALVE

also available in Angle Type (No. 96)

The service ratings of the Walworth No. 95 are 150 pounds per square inch steam at 500F, and 300 pounds per square inch non-shock cold water, oil, and gas. In the manufacture of this quality bronze valve, more than 47 gages are used in machining parts to micrometric accuracy, thus insuring interchangeability of parts. For further information see your local Walworth distributor, or write: Walworth Company, 60 East 42nd St., New York 17, N. Y.

note these 7 Great Features

Hexagonal Union Bonnet Connection: Eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and assembled.

WALWORTH
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

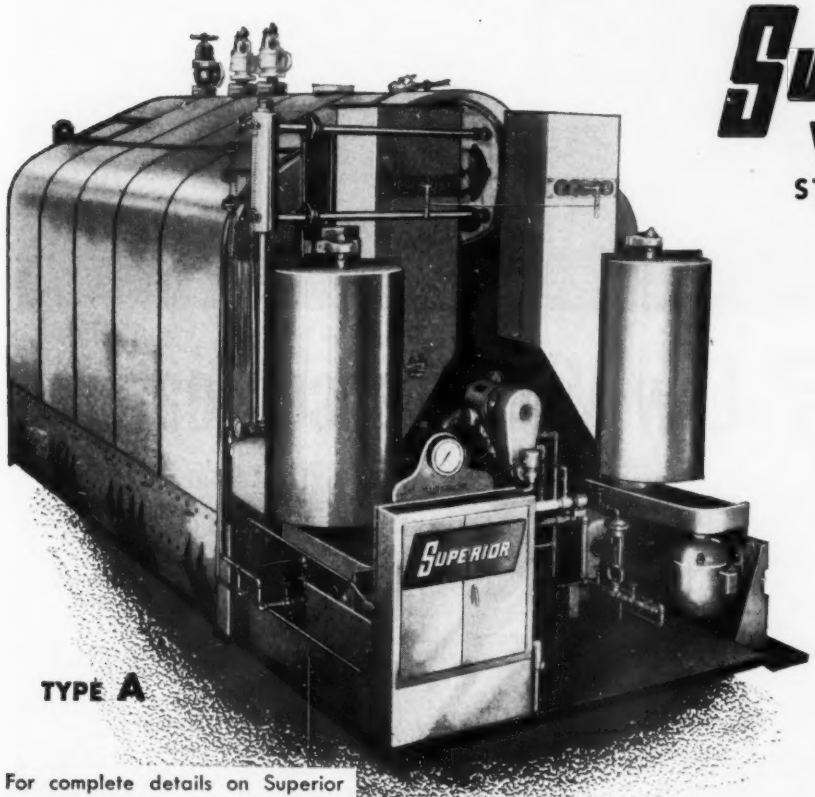
New Cylindrical Disc Holder: The design of the top portion of the disc holder keeps the disc accurately guided under all operating conditions.

Renewable Asbestos Disc: This disc is suitable for steam up to 500F and is resistant to oil, gasoline, and many chemicals at atmospheric temperatures. Discs for special services are available.

Extra Strong Body: Made of Composition M (ASTM B61) bronze thick enough to provide a high safety factor. Valves undergo hydrostatic shell test of 450 psi.

33,000

LBS. OF STEAM PER HOUR



TYPE **A**

For complete details on Superior Water-Tube Steam Generators write for illustrated catalog 500-W

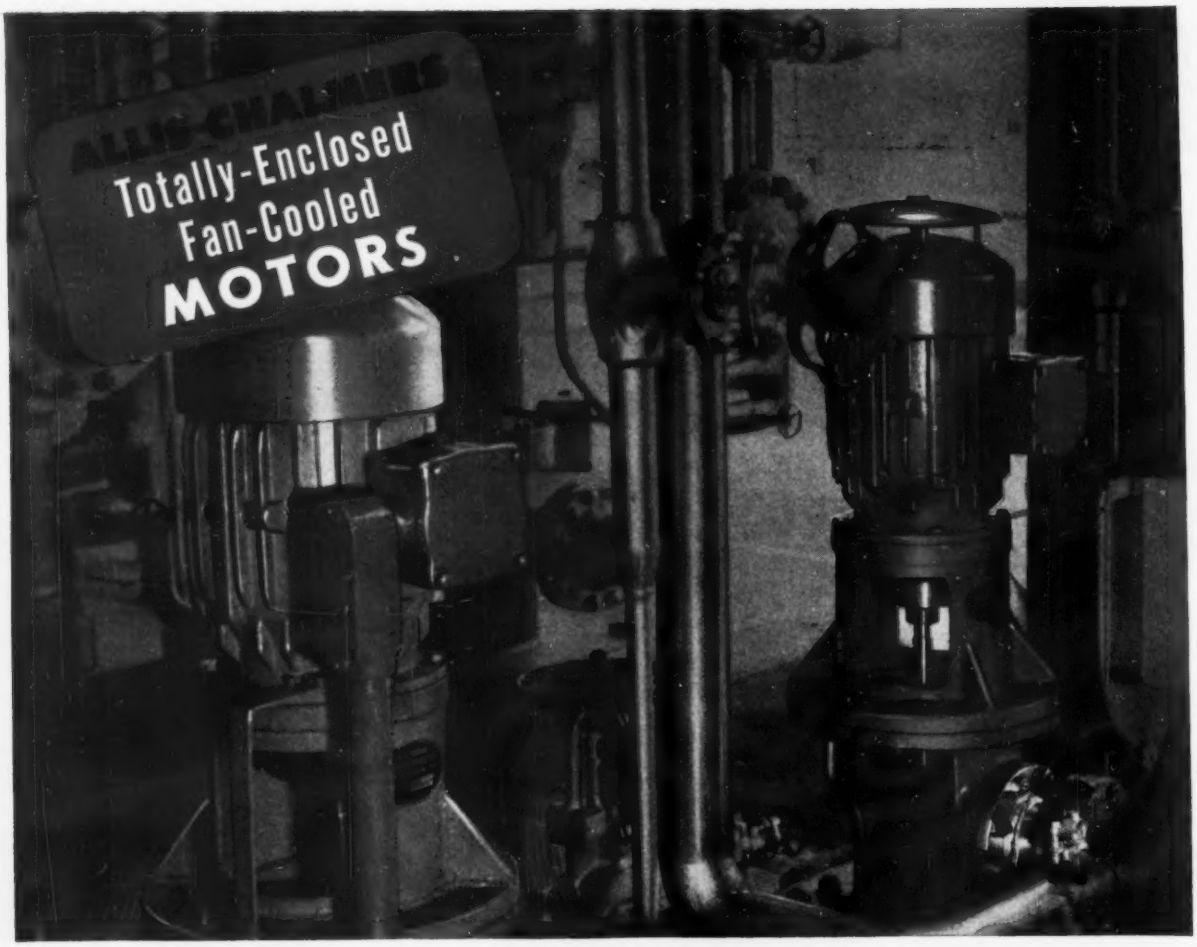
SUPERIOR WATER-TUBE STEAM GENERATORS

1. Completely factory-assembled and tested, Superior Water-Tube Steam Generators are backed by undivided responsibility.
2. Fully automatic operation results in fuel economy . . . firing follows the load demand without waste.
3. Built in 9 sizes with capacities ranging from 5,300 to 33,000 lbs. of steam per hour.
4. Pressures to 400 p.s.i. . . . higher pressures on special order. Can be equipped with superheaters.
5. Efficient type "A" symmetrical tube arrangement for quick steaming, even evaporation, and ease of maintenance.
6. Burns any grade of oil or gas. Unobstructed fire box floor provides for installation of stoker.
7. Built-in multiple induced draft fans provide cleaner, quieter, safer operation; eliminate need of expensive chimney.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR STEAM GENERATORS



Get These 3 Low Maintenance Features

1 Wide Open Air Flow

No enclosed external air passages to clog. Easy to clean with cloth, brush, air hose or vacuum. Simply remove fan cover and whole radiating surface is exposed for inspection and cleaning.

2 Cast Iron Construction

Frame, conduit box and fan cover of cast iron resist corrosion. Fan is non-sparking, corrosion-resistant material. Well suited to outdoor operation.

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

3 Pre-lubricated Bearings

Ball bearings are double-shielded type, pre-lubricated at the factory. Periodic lubrication is not required under normal operating conditions, but provision is made for in-service lubrication if necessary.

GET COMPLETE INFORMATION on Allis-Chalmers motors for indoor and outdoor service — complete with Allis-Chalmers coordinated control — from your nearby A-C Authorized Distributor or District Office, or write for Bulletins 51B7286 and 51B7149. Allis-Chalmers, Milwaukee 1, Wisconsin.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Distributors, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE V-belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

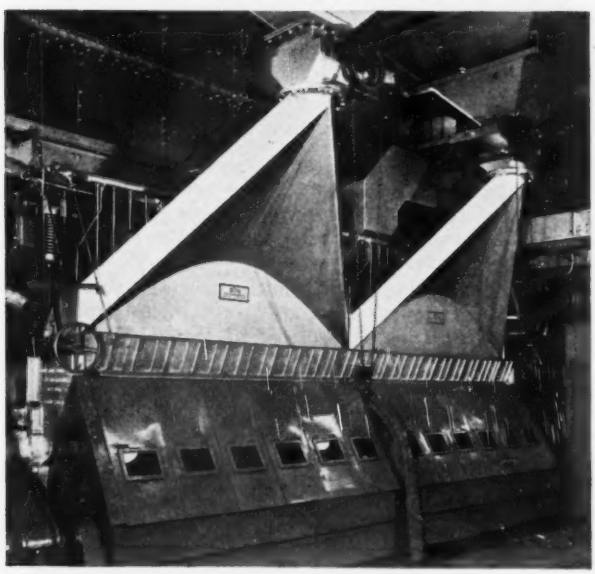
A-4039

The Engineer With Bifocals

has had years of experience firing many different makes of stokers. He knows that non-segregated coal feed gives him a better fire, and, hence, higher efficiency and more capacity.

Whether you have the good judgment of the age of bifocals or if you still have the keen eyesight of youth, you will have no difficulty seeing better results on your stokers with S-E-Co. CONICAL Non-Segregating Coal Distributors.

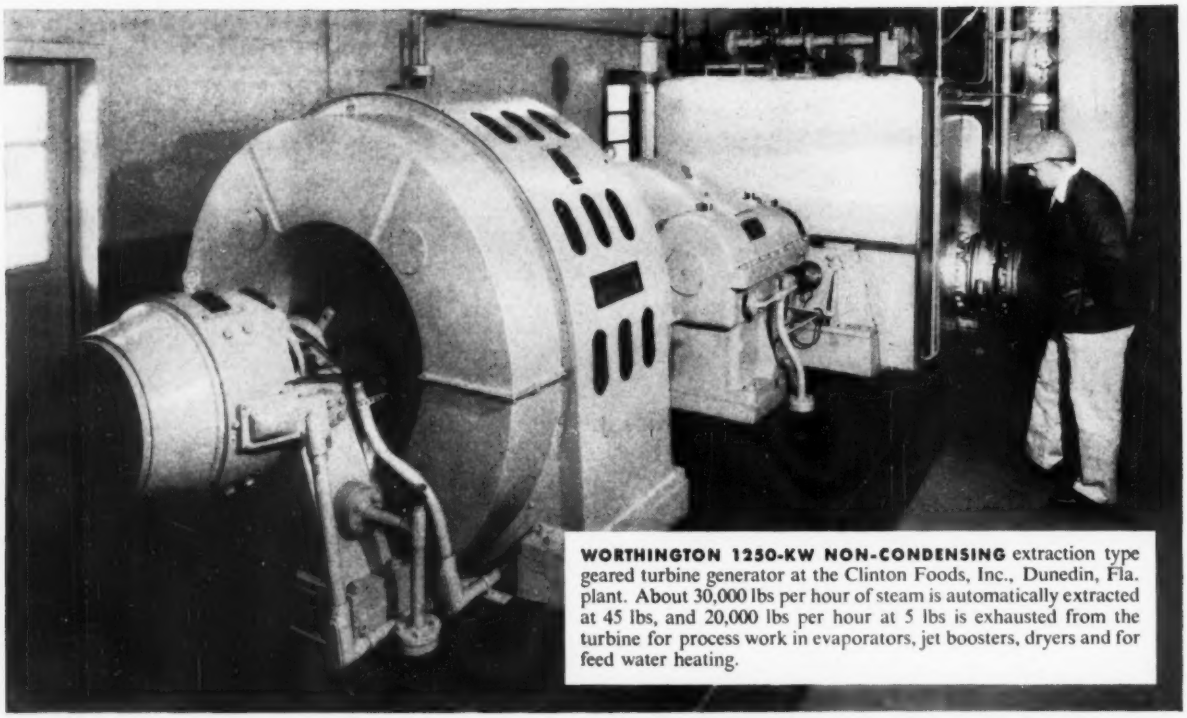
S-E-Co. CONICAL Non-Segregating Coal Distributors feeding a Combustion Chain Grate Stoker at the Canal Road Plant of the Cleveland Electric Illuminating Company



WRITE FOR NEW BULLETIN No. 73

STOCK EQUIPMENT COMPANY

745 P HANNA BUILDING
CLEVELAND 15, OHIO



WORTHINGTON 1250-KW NON-CONDENSING extraction type geared turbine generator at the Clinton Foods, Inc., Dunedin, Fla. plant. About 30,000 lbs per hour of steam is automatically extracted at 45 lbs, and 20,000 lbs per hour at 5 lbs is exhausted from the turbine for process work in evaporators, jet boosters, dryers and for feed water heating.

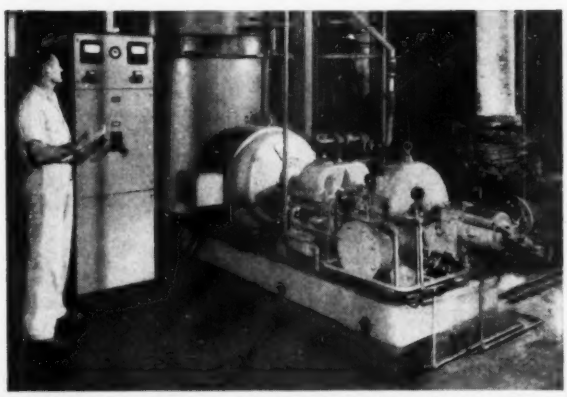
Process steam generates low-cost electricity at Florida orange juice plant

Turbine-generator installation pays for itself in three years

Clinton Foods decided to put some of their process steam to work generating electricity for their plant in Dunedin, Fla. After investigating many kinds of power equipment, plant engineers decided on a 1250 kw Worthington geared turbine-generator set.

After 3 years, the Worthington unit has completely returned its investment in added production and reduced electrical power costs.

So successful was the operation of this unit that Clinton Foods installed another Worthington machine at their by-products mill in their main plant at Auburndale, Fla. This is a 250-kw non-condensing turbine-driven induction generator. Here again, dependable power is supplied in addition to controlled pressure steam taken from the turbine exhaust. This Worthington unit paid for itself in one season. A 7500-kw unit is now being built for the Clinton plant in Clinton, Iowa.



WORTHINGTON 250-KW TURBINE DRIVEN induction generator at Clinton Foods, Inc., plant, Auburndale, Fla. Unit acts as a kw producing-reducing valve and has paid for itself after one season's operation.

By installing Worthington turbine generators, Clinton Foods were assured of low cost power and steam. They were also assured of the undivided responsibility that goes with turbine generators designed, assembled and tested as *complete Worthington units* before shipment.

Sizes to 11,500 kw. For more information, write your nearest Worthington district office, or Worthington Corporation, Steam Turbine Division, Section T.3.1, Wellsville, New York.

T.3.1

A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbine Generators

GEAR TYPES

—capacities to 5,000 gpm, pressures to 500 psi

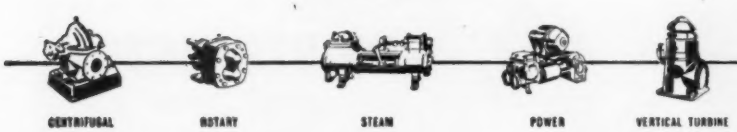
VANE TYPES

—capacities to 1,000 gpm, pressures to 200 psi

This is what Worthington means by a "complete line" of rotary pumps...

Here's one rotary pump line that covers more applications than any you can find anywhere. Whether you pump thin, non-lubricating liquids or viscous liquids, small or large capacities, low or high pressures, with motor, turbine, engine, belt, or variable speed motor drive, there's a Worthington rotary that'll do your job. Units supplied with either conventional stuffing or mechanical seal. Write for Bulletin W-485-B1 on vane types; W-484-B1A (general service—capacities to 51 gpm, pressures to 100 psi), W-484-B2 (corrosive service—capacities to 51 gpm, pressures to 100 psi), and W-487-B10C (heavy-duty service—capacities to 5,000 gpm, pressures to 500 psi) all heavy-duty gear types. Worthington Corporation, Reciprocating Pump Division, Harrison, N. J.

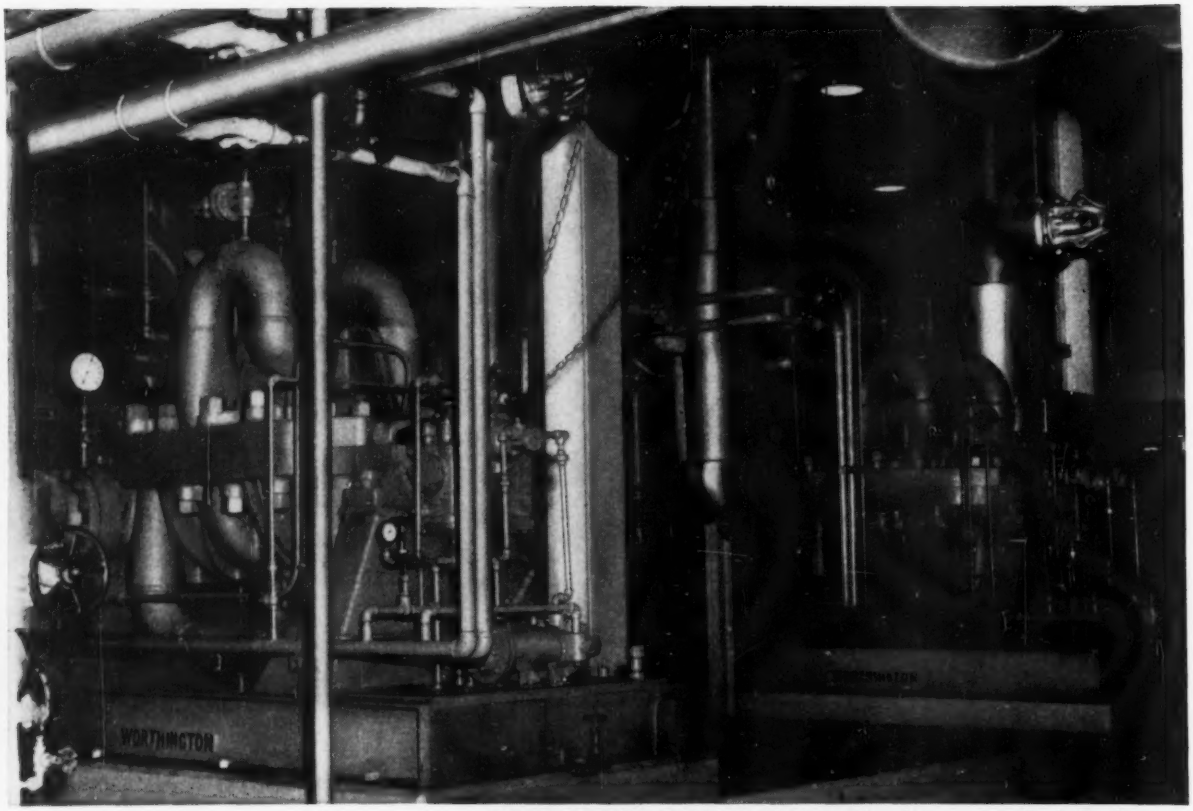
P.2.4



The World's Broadest Line Assures You the Right Pump for Every Job

WORTHINGTON

Rotary Pumps



THIRTY WORTHINGTON BOILER FEED PUMPS have been purchased by the Southwestern Public Service Company of Amarillo, Texas. The two boiler feed pumps above, installed at Southwestern's new Plant X, deliver 1165 gpm, at 1125 psi total head.

Worthington helps bring more power to the Southwest

30 Worthington boiler feed pumps installed by Southwestern Public Service since 1945

Plant X, ten miles north of Amherst, Texas, is the newest and largest of the Southwestern Public Service Company's eleven generating stations. Since September, 1945, Southwestern Public Service has been expanding, building new stations to meet the Southwest's increasing power needs.

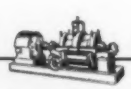
Worthington has played an important part in this expansion. During the past eight years, thirty Worthington boiler feed pumps have gone into Southwestern Public Service power plants. In Plant X alone, Worthington has supplied, in addition to the boiler feed pumps, heater drain pumps, water softeners, sump pumps, air compressors, and the open feed-water heater.

Power engineers everywhere have found that Worthington has kept pace with the increase in capacity and pressure of steam generating units and is prepared to furnish boiler feed pumps for any modern power plant requirements.

We'd like to hear about your own pumping problems. Get in touch with your nearest Worthington district office, or write directly to Worthington Corporation, Centrifugal Pump Division, Section C.3.5, Harrison, N. J.

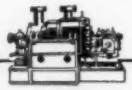
C.3.5

For Boiler Feed Service. Capacities to 1,500 GPM; Heads to 1,000 feet.



For Hotwell, Condensate, Chilled Water Service. Capacities to 1,400 GPM; Heads to 650 feet.

For Water Works, Circulation, Drainage, General Service. Capacities to 135,000 GPM; Heads to 400 feet.



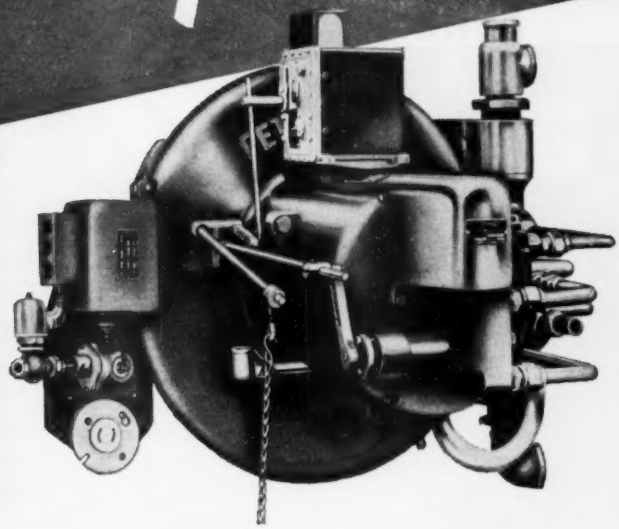
For Boiler Feed Service. Capacities to 3,000 GPM; Heads to 7,000 feet.

WORTHINGTON

Centrifugal Pumps

The World's Broadest Line Assures You the Right Pump for Every Job

Have you a steam problem?



A Petro INDUSTRIAL OIL BURNER IS THE SOLUTION

Petro industrial oil burners are your best buy! They operate with high efficiency in practically every type of boiler.

Petro oil burners have world-wide acceptance. Their dependability is traditional. They are recommended by leading heating contractors everywhere. Fifty years in oil firing gives the Petro organization an exceptional degree of engineering experience and practical "know how."

Petro's outstanding ability to burn heavy, low-cost oils with maximum efficiency has reduced fuel costs in thousands of plants and buildings.

See Petro section in Sweet's Architectural File, or write for catalog and specifications to Petro, 3206 W. 106th St., Cleveland 11, Ohio.

HERE'S WHAT YOU NEED

You need to CUT STEAM COSTS

A Petro industrial oil burner will do it! The Petro burner is designed to burn low-cost heavy fuel oil with high efficiency and complete reliability. Saves money year after year.

You need to CUT LABOR COSTS

A Petro oil burner will do that, too! Completely automatic, it regulates itself without constant attention; frees attendants for other duties.

You need to MEET FLUCTUATING STEAM DEMANDS

A Petro industrial oil burner does just that! The fire can be modulated to meet the most extreme requirements of varying steam loads.

You need to do all this AT LOW COST without replacing your present boiler equipment.

INDUSTRIAL, COMMERCIAL and RESIDENTIAL OIL BURNERS FOR EVERY FIRING NEED

50 Years of Leadership in Automatic Heating and Power Equipment

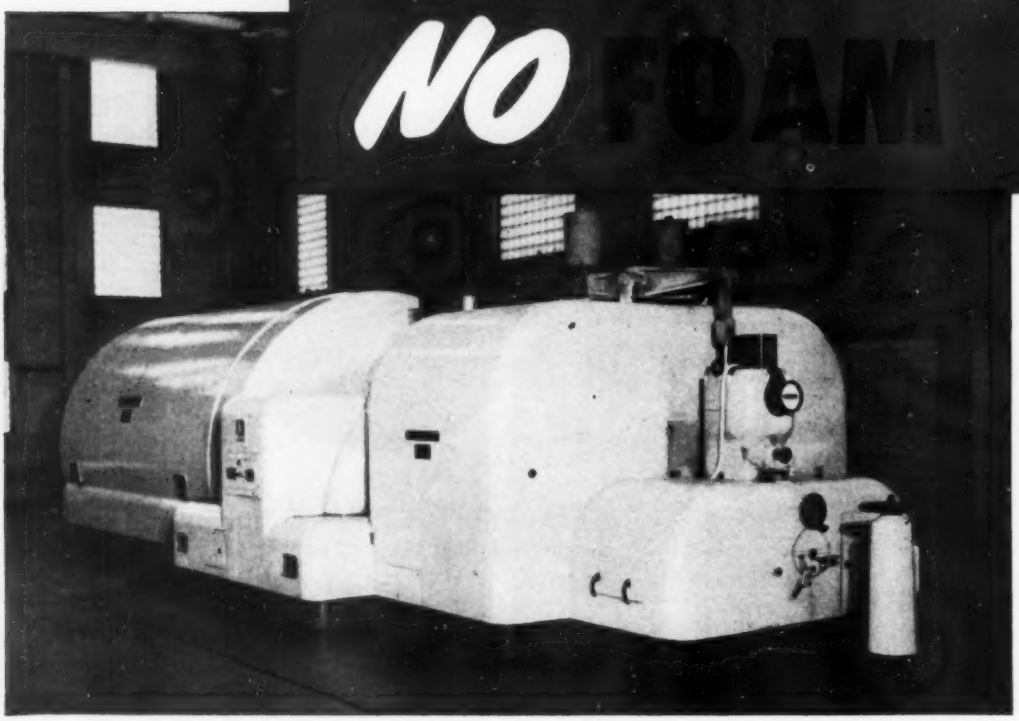
PETRO

3206 W. 106th St., Cleveland 11, Ohio

In Canada: 2231 Bloor St., West, Toronto, Ontario

Why this turbine system has

NO RUST
NO SLUDGE
NO FOAM



THE turbine shown is lubricated with *Texaco Regal (R&O)*. This is the oil that tests prove has *more than ten times the oxidation-resistance* of ordinary turbine oils, and far superior rust- and foam-inhibiting ability.

Because *Texaco Regal Oil (R&O)* does such a fine job of keeping turbine systems clean, you can count on keeping bearing temperatures normal and governor response instantaneous. You can also count on extra-long service from the oil itself.

There is a complete line of *Texaco Regal Oils (R&O)* . . . for every type and size of turbine, every operating condition. They meet the stringent requirements of all leading turbine builders.

Let a Texaco Lubrication Engineer show you the benefits of using Texaco Lubricants throughout your plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R & O)

FOR ALL TURBINES

Industry Swings to Modernization

INDUSTRY HIRES executives and department heads to build up net profits—the elusive margin between what the business takes in and what it pays out. The job of sales and advertising executives is to increase the intake. Production men and power engineers are hired to cut down the outgo. The two groups are partners in the profit-making team.

Some top executives underrate the power engineer's importance as a profit maker. They say, "Why worry about power costs when they amount to only 3 or 4 percent of total sales?" They forget that if 4 cents out of every sales dollar now goes for power services, chopping off just one cent will increase the net profits of the average business by 10% or more. Figure this out yourself for your own company.

But what about this one-cent-in-four saving in power-service costs? Is it obtainable?

In our opinion, after visiting many hundreds of plants, intelligent modernization of all power services could easily save 25 percent in the average establishment.

Take steam, for example: Modern boiler equipment not only raises efficiency substantially, but also often yields even bigger savings by making it possible to burn bargain-priced fuel.

But cheaper Btu and better boiler efficiency are only the beginning; other big savings can be made in steam transmission and application. Modernizing transmission cuts costly waste through inadequate insulation and defective valves, fittings and traps. And there is often the chance to plug big steam wastes at the process or consuming end.

Parallel opportunities are at hand in the generation and application of electricity, mechanical power, refrigeration, heating, air conditioning and compressed air.

This year marks industry's great swing from new construction to modernization. As new construction gradually slows down from the high defense-effort peak, modernization must pick up much of the slack. That will keep the nation's wheels rolling at a good clip, and offer thousands of plants the opportunity to cut operating costs by replacing or revamping obsolete equipment and hookups.

Such recent renovation obstacles as rationing and equipment shortages have largely disappeared. Nothing more is needed except progressive power engineering, working hand-in-hand with top management to build profits by cutting waste.

With this national situation in mind, POWER has been working for months building up the *Modern Plant Handbook* issue. Designed for year-round reference use, this will appear in mid-September as an extra issue. The regular September issue of POWER will bring you the usual complete monthly editorial service.

A top feature of the *Modern Plant Handbook* will be the 16-page Renovation Roundup, listing hundreds of practical ways to save dollars in the modernization of all the power services—their generation, transmission and application.

Other Handbook sections include: Modern Plant Survey—tabulated data on over 500 new steam and hydro units; Directory of Power Field Manufacturers—more than 1000 manufacturers under 600 product listings; The Show Case—new products reported during the year.

The aim is to give POWER readers a convenient "modernization package," to help them (1) organize the facts about their own plant, their present and future load conditions and (2) see just where and how intelligent modernization saves operating dollars.

KENNEDY AIR SWEPT

...maximum combustion...

FULLY AIR SWEPT

•

COAL PULVERIZED TO SUPERFINENESS

•

COAL COMPLETELY CARBURETED . . . Ready for combustion

•

BIG TRUNNIONS FOR AIR SWEEPING

•

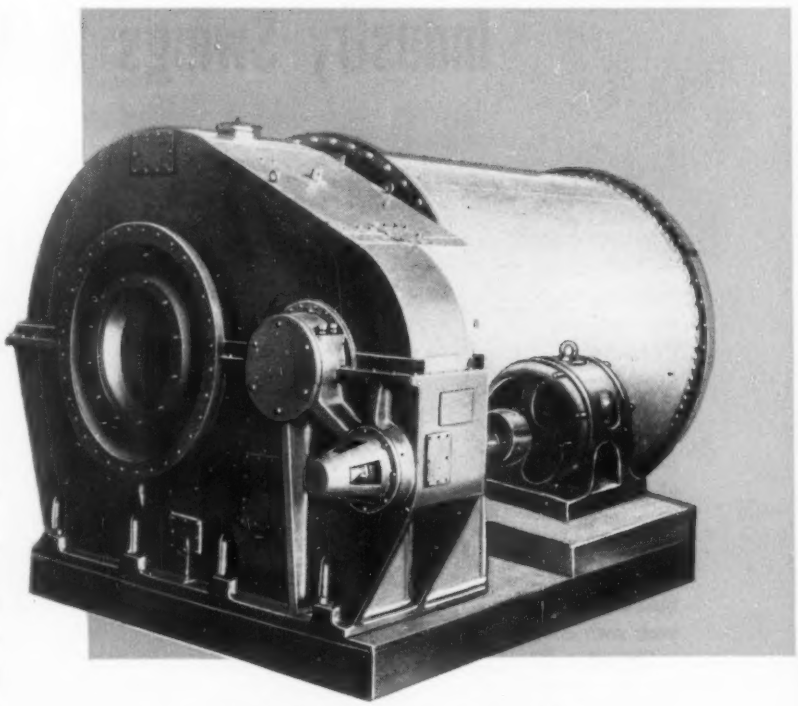
BALLS ADDED WITHOUT SHUTTING DOWN

•

LOW OPERATING AND MAINTENANCE COSTS

•

UNBURNT CARBON LOSSES LESS THAN ½%



AIR SWEPT TUBE MILL Slow-speed ball mill for perfect pulverization. Low-cost grinding, regardless of hardness. Balls can be added without shutting down. Continuous operation, better than 99% availability

KVS Air Swept Tube Mills provide extremely fine pulverization, making possible the efficient burning of any grade of coal from the *cheapest* to the *highest*.

Cumulative savings in fuel costs, made possible through complete combustion, reach tremendous figures. Maximum heat

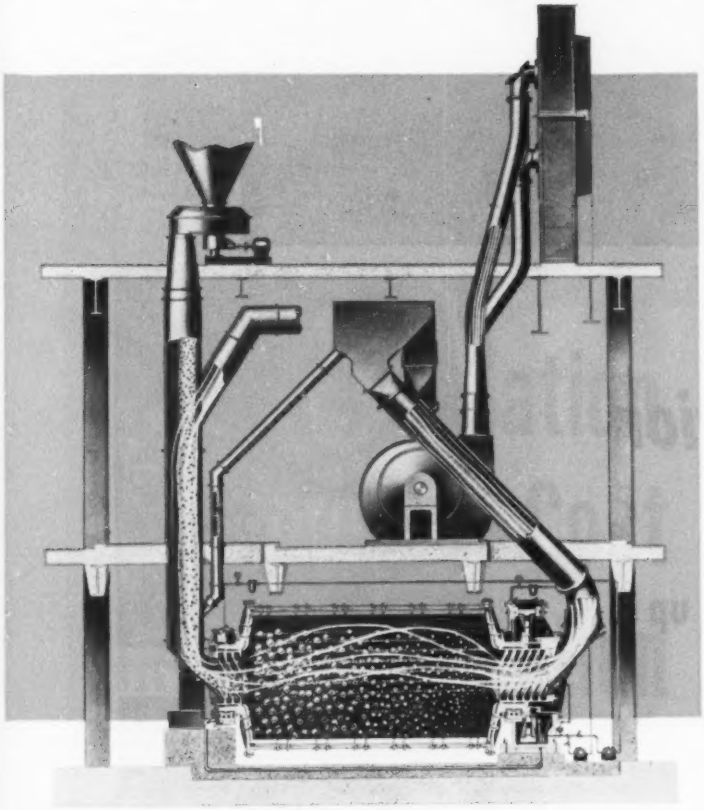
IT COSTS LESS.. TO OWN THE BEST!

GET THE FULL FACTS ON KVS COAL FIRING SYSTEMS:

Find out how you can cut coal costs materially. Stop buying premium coal. Save more than a dollar per ton! Send for the facts, today!

TUBE MILLS PROVIDE

...with all grades of coal!



KENNEDY COAL FIRING SYSTEM showing disc feeder, pulverizer, classifier, exhauster and burners.

value is obtained from every ton of coal burned. The result, ... *more heat* and *more power* from any given quantity of coal.

The KVS system assures rapid coal firing. Pulverized fuel is available, as required, to meet fluctuating conditions and give instant, flexible response to the combustion controls.

INSTANT RESPONSE TO CONTROLS

•

85% TO 90% THROUGH 200 MESH

•

20% MOISTURE REMOVED WHILE PULVERIZING

•

PULVERIZES *ANY* COAL, BITUMINOUS, ANTHRACITE, COKE BREEZE

•

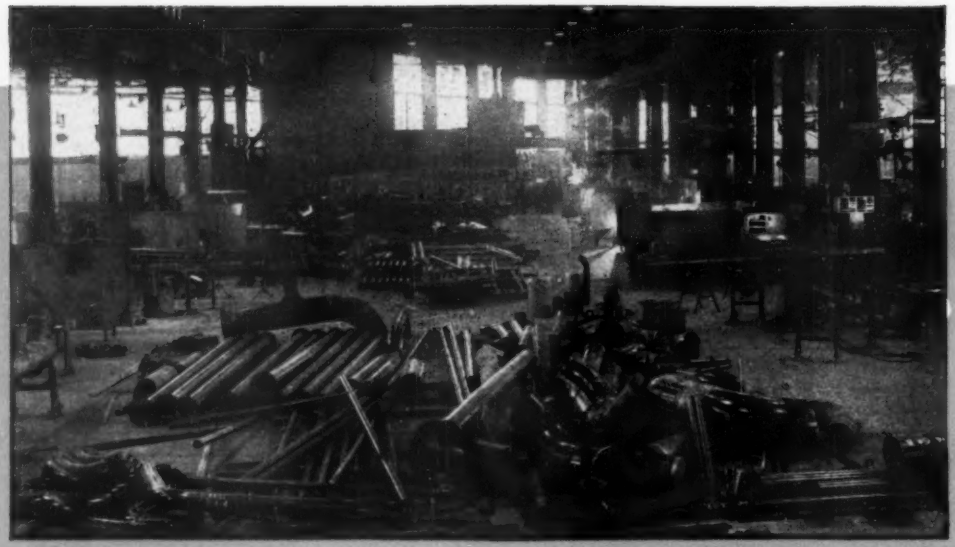
TRAMP IRON ACTUALLY AIDS IN PULVERIZING

•

RESERVES OF FUEL FOR INSTANT RESPONSE AND STEAM DEMAND

SEND FOR bulletins describing KVS coal firing systems and waste heat boilers.

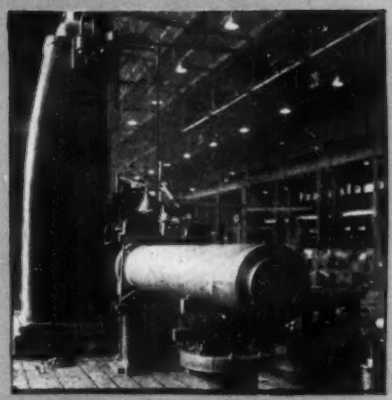
KENNEDY - VAN SAUN
MANUFACTURING & ENGINEERING CORPORATION
TWO PARK AVENUE, NEW YORK
FACTORY DANVILLE, PA.



Part of the welding floor at Grinnell's Warren, Ohio Plant

How shop fabrication of piping

keeps costs down...quality up!



Heavy wall pipe being machined to the proper welding bevel on a post mill

Welding (induction heating coils in place for preheat, welding heat and stress relieving.)

When you specify piping fabricated in Grinnell shops, you are ALL to the good.

Here's why: — Included in the price (which is determined in advance) are such items of expense as:

- Interpretive engineering
- Shop sketches and planning
- Procurement of materials
- Heat, light, power, water, compressed air, expendable tools and supplies

But Grinnell even goes further. Grinnell finances material inventories and payrolls for you; carries insurance; makes no charges for waste material or spoilage.

On the production side, too, you benefit. Piping fabricated in Grinnell shops is done under ideal conditions, with modern equipment, by personnel qualified for each class of work. It is rigidly inspected and tested to meet customer's specifications and all applicable codes. Before shipment, it is cleaned inside and outside and painted. It is squared to dimensional tolerances, so that sub-assemblies can be erected at the job site quickly and easily.

You can count on it . . . Grinnell shop fabricated piping *guarantees* maximum quality and economy.

GRINNELL

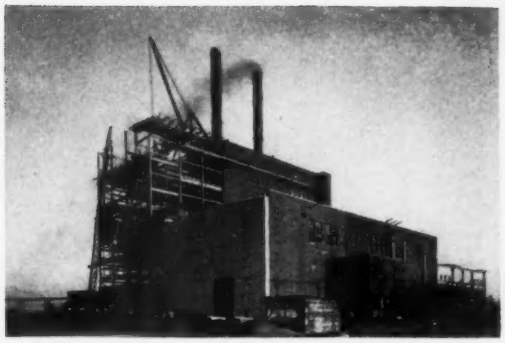
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

Power

JULY 1953



JUSTIN R WHITING PLANT of Consumers Power Co, near Erie, Mich. Units No. 1, 2 operating, No. 3 building

Smart Insulation Methods Cut Cost In Modern Station

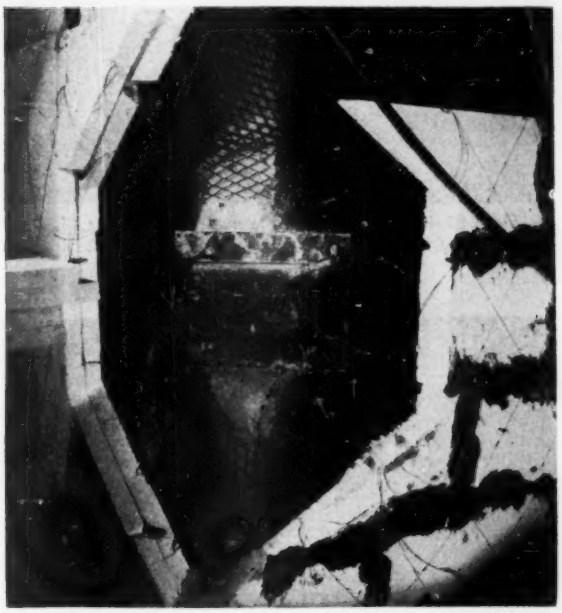
The key to better insulation in any plant is good application of suitable materials. This is especially true in today's high-pressure high-temperature stations where the right materials and methods cut costs from start to finish of installation, and during every day the plant runs.

Here's a picture story showing many of the methods chosen for a 1480-psi 1000-F reheat station of Consumers Power Co, Erie, Mich. Starting at the boiler we follow steam flow to superheater, main steam line and turbine, stopping at each to see the insulation application techniques selected.

Though any insulation saves Btu's, the right material correctly applied does far more. Its maintenance cost is lower, appearance neater, life longer. The insulation shown here is Kaylo (hydrous calcium silicate) but many of the modern installation methods pictured are suitable for other high-temperature insulating materials.

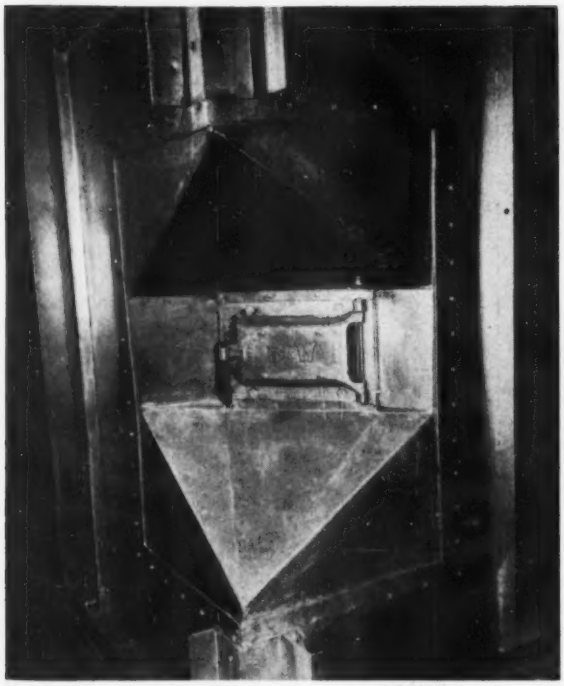
For more pictures, turn page ►

1 Early stage in insulation application around corner inspection door on boiler. Lath, studs, tie wires ready

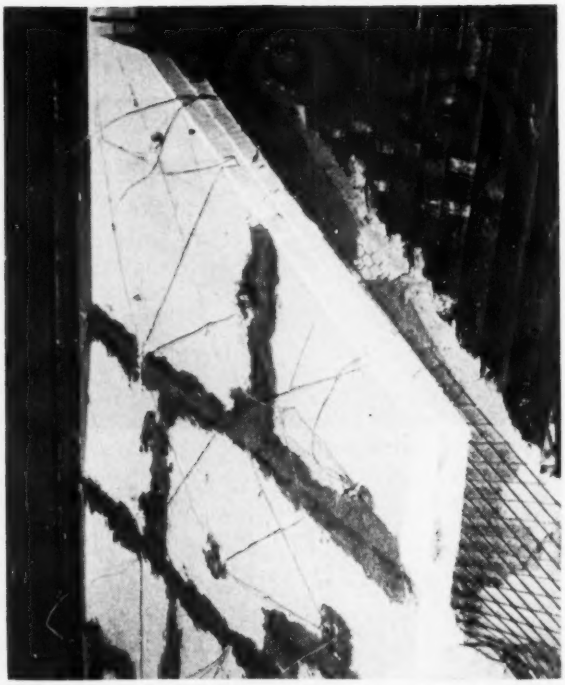


2 Inspection door is now almost completely surrounded with insulation. Tie wires have been pulled through, fastened

3 Sheet-steel casing is applied over insulation after the insulating cement is dry. Casing helps protect the job

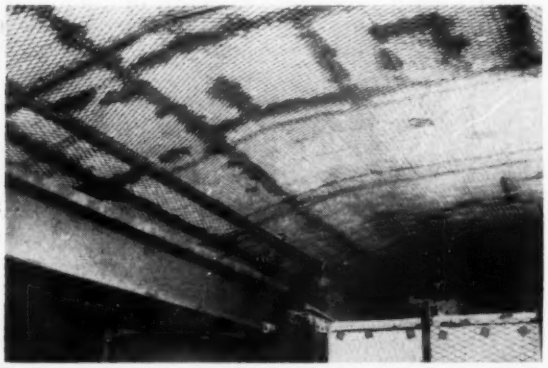


4 Finished inspection door has neat appearance, is tight and trouble-free. Shape of opening permits easy access

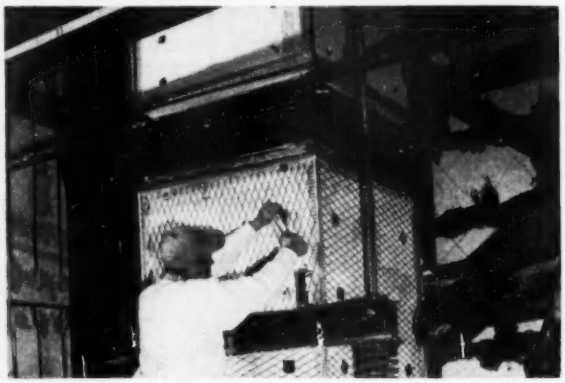


5 Top of boiler side wall with 4-in.-thick blocks in place. Metal lath, insulating cement separate blocks from tubes

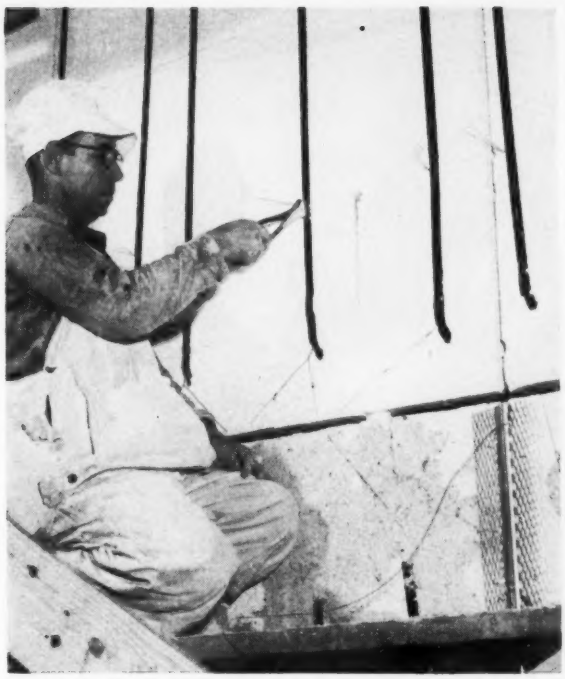
8 Securing tie wires for block insulation on boiler superheater wall. Block joints pointed with insulating cement



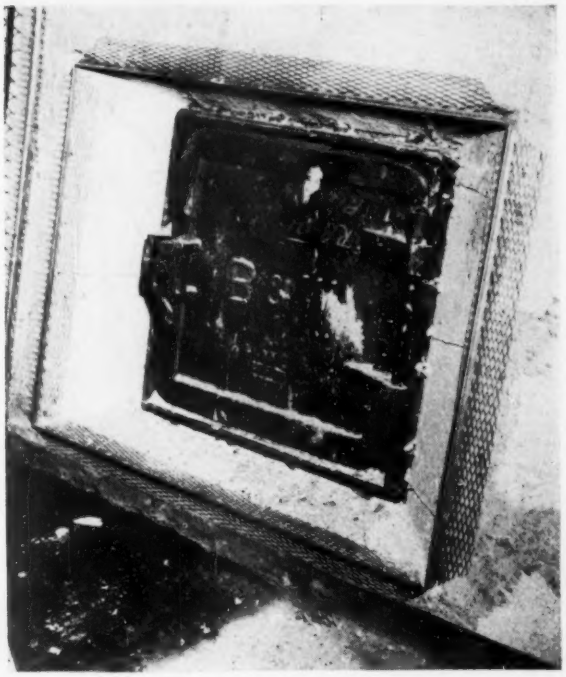
9 Breeching, *top*, showing metal lath applied over blocks. The induced-draft fan duct, *bottom*, is block insulated



10 Here half-nuts are being applied to a welded stud on the recirculating-air duct. Stucco lath is over insulation



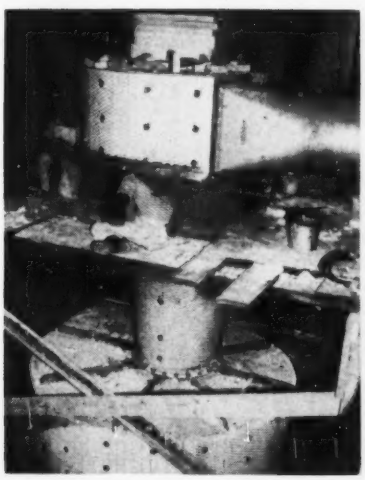
6 Metal straps tie insulating blocks to mesh on back wall of air heater. Note the expansion joint at lower right



7 Air-heater inspection door showing corner beading, lath and tie wires. Metal straps (not shown) are also used

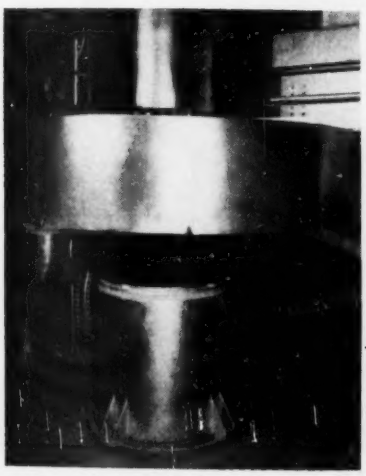
Many Application Methods Are Used in Insulating a Modern Boiler

Careful planning and accurate fitting insure a tight job, good for many years of service. In this photo story, neat finish shows work quality



11 Early steps in applying the block insulation to cyclone separators

12 Secondary collector during application of the curved block insulation



13 Finished insulation job on the fan above the secondary dust collector

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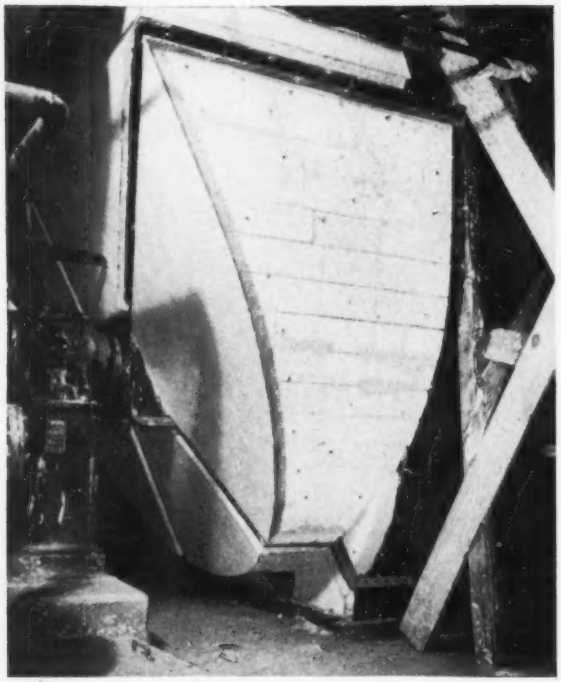
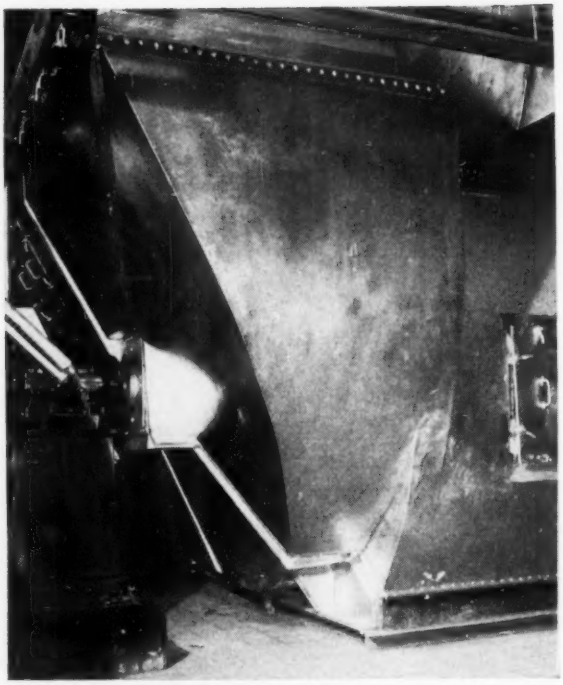
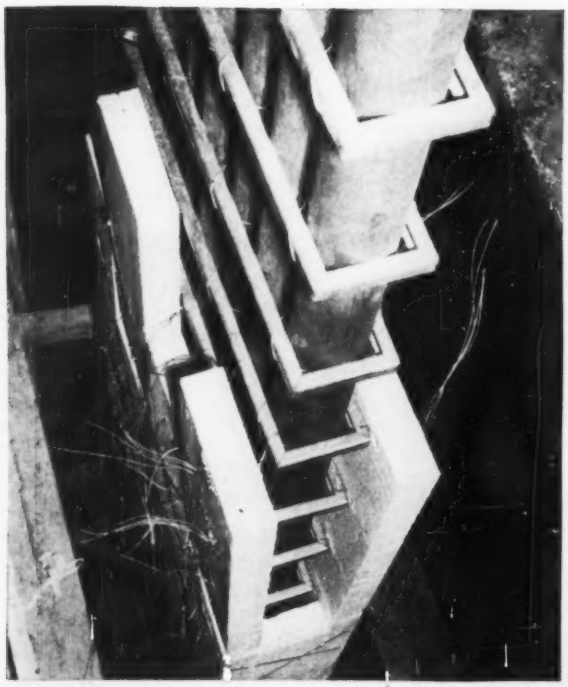


14 Block-insulated induced-draft fan. Studs hold blocks in place and corner-beaded lath gives a neat edge trim



15 Finished induced-draft fan after application of surface finish and paint. The smooth exterior is easy to clean

Induced-Draft Fan and Main Steam Lines Take Two Layers of High-



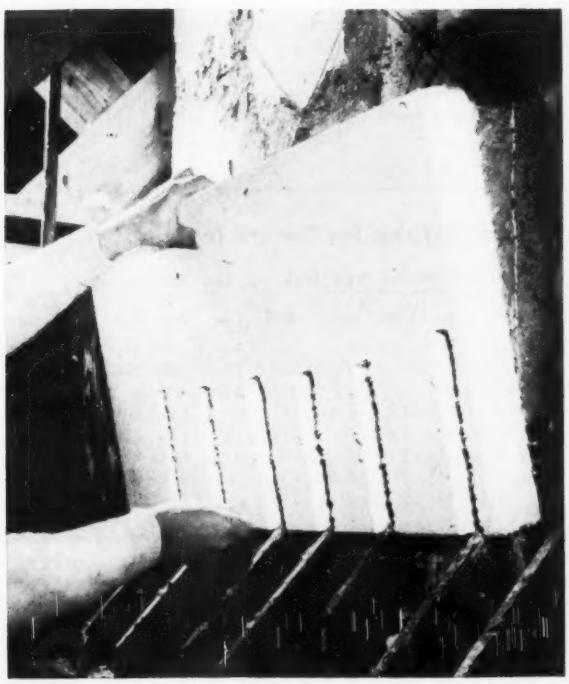
18 Start of block application to main steam lines showing the tie wires that hold the blocks to frames on pipes

19 Second layer of block insulation is wired to main steam lines. Pointing cement already applied to first layer

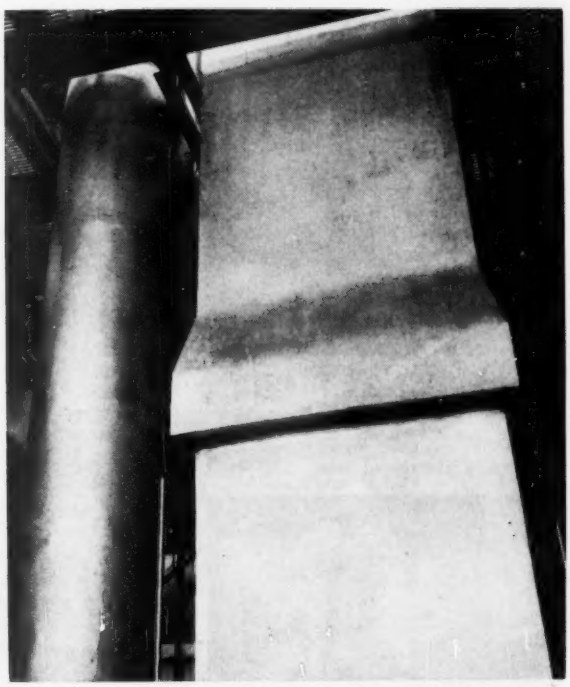
16 Steam at 1000 F leaves boiler from two secondary outlet headers having seven 5-in. tubes. Two layers on tubes

17 From tubes, steam flows through these main lines before entering turbine. Frames on lines will support blocks

Temperature Insulation, Have Smooth, Well-Finished Exteriors

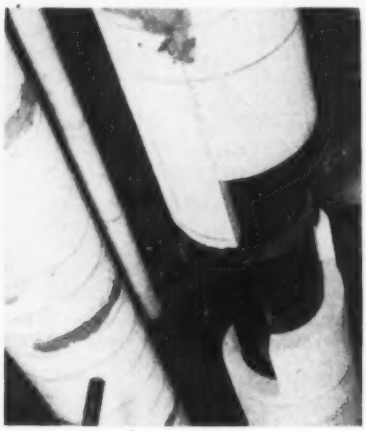


20 Specially notched block being applied to the expansion joint in the insulation surrounding the main steam lines



21 Finished expansion joint in vertical steam lines running between boiler and turbine. The work is neat and clean

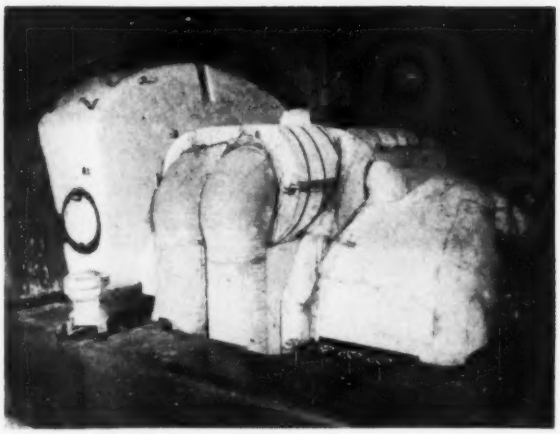
22 Tightening tie wire around insulation on heater bleed from turbine



23 First layer of insulation on 14-in. reheat line. Total thickness is 6 in.

24 Second layer, finish and expansion-joint covering on the reheat lines

25 Insulation and supports for main steam and reheat lines, Unit No. 1



26 High-pressure end of turbine for No. 2 unit with insulation applied. Casing over insulation completes the job

Details of Whiting Plant Insulation

Table below gives schedule of thicknesses chosen for various temperatures and pipe sizes at Whiting. All high-temperature insulation is Kaylo (hydrous calcium silicate) preformed for application on flat and curved equipment and pipes in the plant.

Pipe insulation is nested; that is, outside diameter of first layer is a size that permits second layer to fit snugly. Fastening method varies with surface insulated, wires, studs and lath being used as illustrated. Pipes and valves are finished with canvas and cement to give a smooth exterior, easy to paint and keep clean at all times.

Expansion joints in pipe, duct and flat-surface insulation are specially constructed and carefully located to insure freedom of movement without danger to the insulation. Metal corner beads protect block edges, give a neat and true finish of lasting quality.

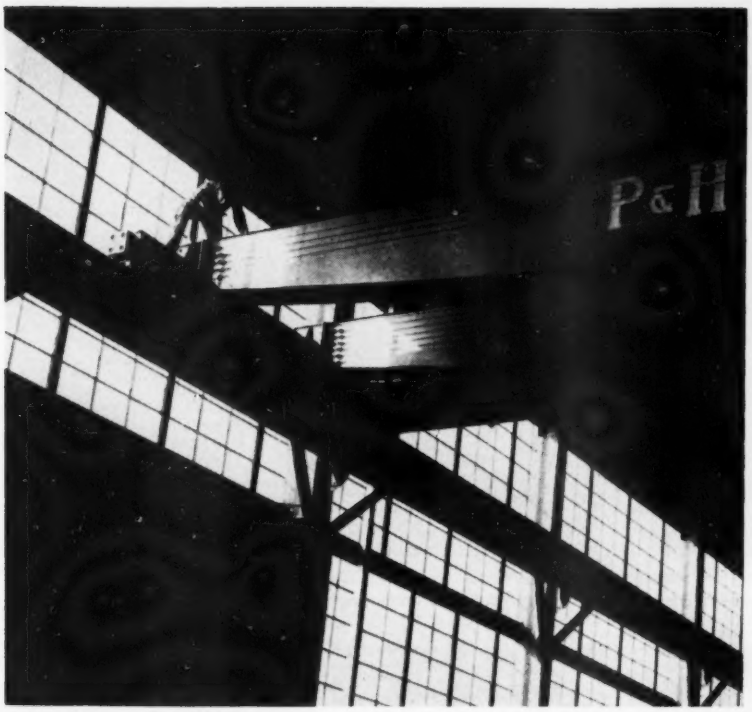
Though only high-temperature insulation is illustrated here, a number of other materials are used in the 40-90 F range. Table below shows typical specifications for them.

With Units No. 1 and 2 operating, and No. 3 nearing completion, experience proves the application methods illustrated give good service.

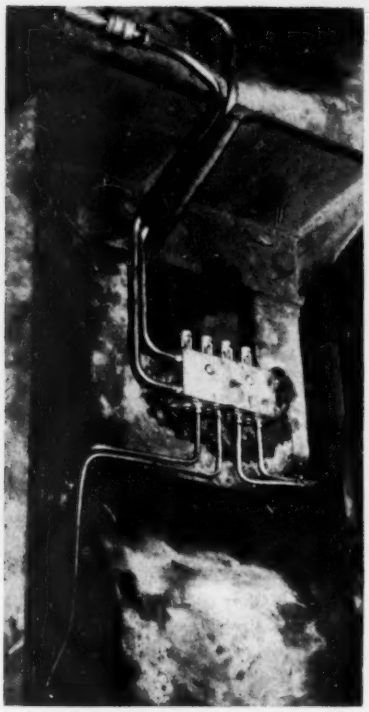
Insulation Thickness for Various Pipe Sizes and Temperatures

	Pipe Sizes in Inches, With High and Low Temperatures											
	½-¾		1-1½		2-4		5-8		10-14		16 & over	
Degrees, F	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
150- 350	—	1	—	1	—	1	—	1½	—	1½	—	1½
350- 450	—	1½	—	1½	—	1½	—	2	—	2½	—	2½
450- 550	—	2	—	2	—	2	—	2½	—	3	—	3
550- 650	2	—	2	—	1½	1½	1½	2	1½	2	1½	2½
650- 800	2	—	2	—	1½	2	1½	2½	1½	2½	2	2½
800- 900	2	—	2	—	2	2	2½	2	2½	2½	2½	3
900-1000	2	—	1½	1½	2	2½	2½	2½	3	2½	3	3
1000-1200	2½	—	1½	1½	2	2½	2½	2½	3	3	3	3½

40-60	Two ½-in. layers of antisweat covering (well water and drinking water)
60-90	One layer of 1-in. wool felt (river water)
60-90	Cork spray built up to a minimum of ½-in. thickness Sheet-metal protective covering Asbestos-cloth protective covering Waterproof cement
40-90	One layer 1-in. hair felt tied on with jute twine or No. 14 Copperweld wire on 6-in. centers, ½-in. asbestos cement; poultry netting with ¼-in. waterproof cement finish



REACHING LOFTY HEIGHTS with an oilcan is a dangerous, inefficient lube method. Oiler has strong temptation to skip hurriedly through and scurry back to ground



MEASURING VALVES respond to pump pressure, doling out grease at bearings

Crane Lubrication

Made Safe, Sure, With Centralized System

By J A GORDON
Farval Corporation

CENTRAL PUMP, hand operated, sends grease sliding through tubing to valves. Gage shows the grease pressure developed

► A CENTRALIZED LUBE SYSTEM has the lube supply at one central point with tubes radiating out to lube points on machine. In general, centralized systems show many advantages. Most obvious is simply better lubrication—proper quantity of lubricant delivered at the right time.

For some years, management at the Thypin Steel Co in New York City "farmed out" their crane maintenance, lubrication included, to an outside contractor. But they were concerned over the safety angle as well as frequency and thoroughness of lubrication.

Lubricating a crane is a hazardous job—hazardous to both oiler and men on floor below. Problem of safety and effective lubrication has been neatly licked with a centralized system.

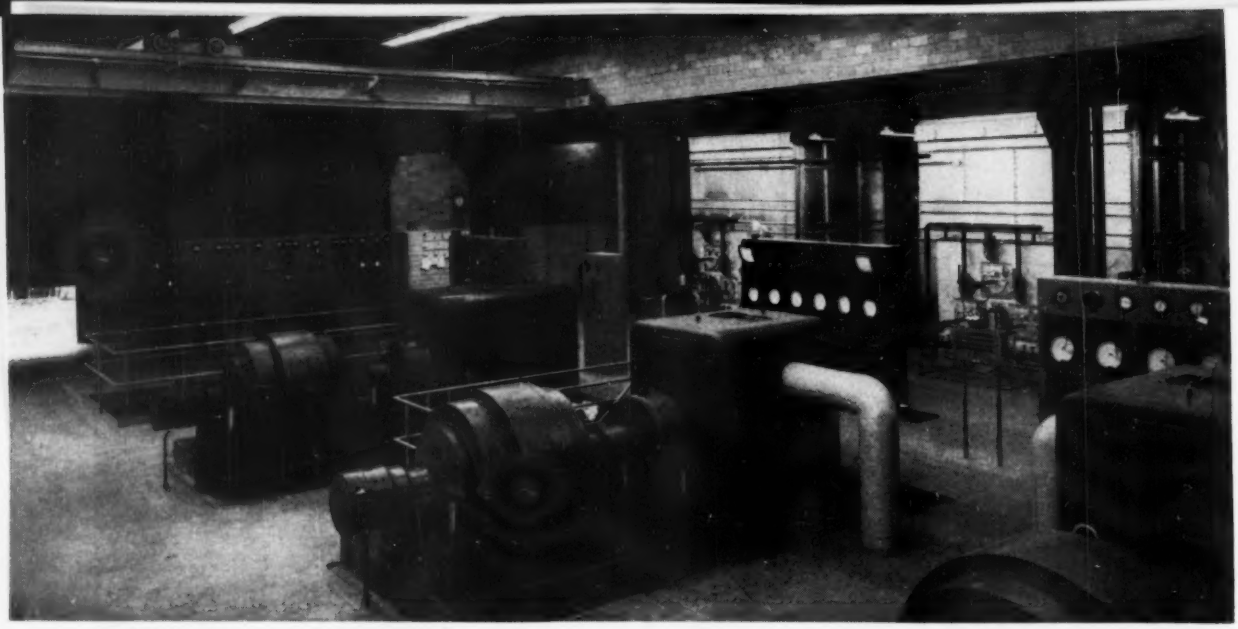
System Details. Each crane in the plant has a single bridge and two trolleys. The bridge alone has 14 lube points. Each trolley has eight points requiring lubrication.

The new centralized lube system consists of three hand-pumped grease-dispensing units, measuring valves, piping and tubing. One pump handles the 14 points on the bridge, while the remaining two units feed the two trolleys.

The measuring valves, between pumps and lube points, are fully adjustable for lubricant quantity, besides being equipped with a positive, easily seen indicator. Each trolley has two measuring valves, one valve serving four points.

Piping. The soft grease, NLGI No. 1, is carried from each pump unit through ½-in. pipe serving as a main feeder. Since the measuring valves are hydraulically operated, a 2-pipe system is used. Pressure is alternately applied to each feeder line.

Main feeders are tapped by ⅜-in. tubing, which carries grease direct to measuring valves. Lines from valves to lube points are ¼-in. tubing.



1 Electrical-energy requirements run heavier, relatively, than steam during summer and fall but, nevertheless, reach their peak in winter. As a result, plant needs both condensing and noncondensing turbine generators for best economy

Reliability, Continuity Mark Institutional Plant

Complete gamut of power services—electrical energy, steam, compressed air, hot and cold softened water—features the modern institutional power plant so that failure of powerhouse equipment proves costly and dangerous

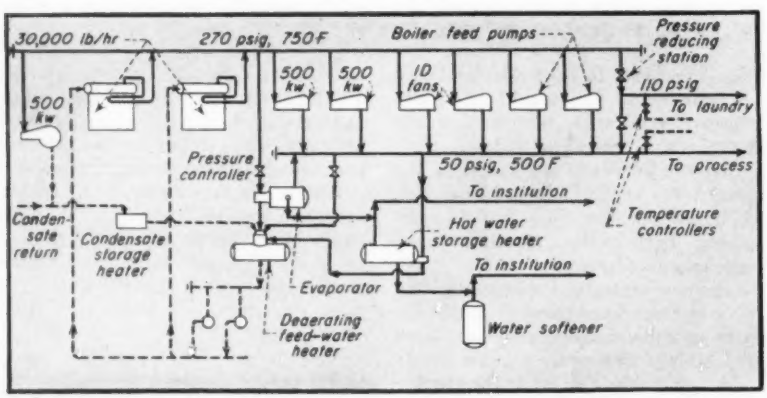
By L J NEUBAUER, *Ellerbe & Co, St. Paul, Minn.*

► SERVICES, OPERATION, economy, reliability and equipment layout, almost in that order, dictate institutional powerplant design. When the Rochester, Minn. State Hospital came in for expansion to serve an eventual 3000 patients, the first phase included a new power plant. Besides straightforward planning for final conditions, the new operating features had to permit economical interim power services.

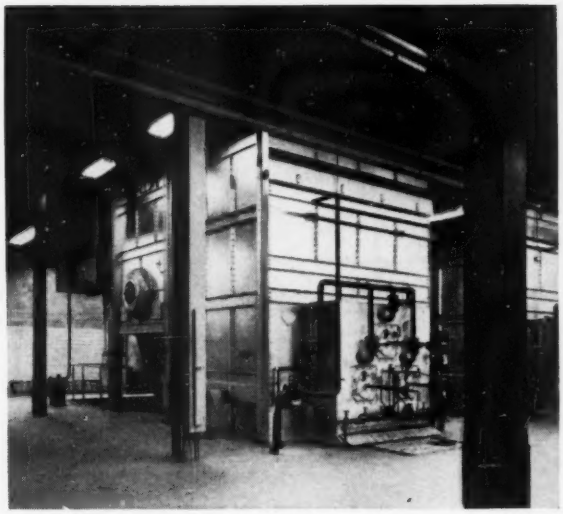
These services include steam at different pressures, Fig. 6, electrical energy, cold and hot softened water, compressed air. There was immediate need for 40-psig steam for sterilizers and at lower pressure for heating nearly all buildings, including those in the first expansion. So we chose 50-psig steam for distribution to buildings, then specified local reducing stations to drop this pressure for heating systems. On top of this general steam demand was a special 100 psig for laundry mangles, presses, other equipment.

Electrical-energy needs include ac and dc. Dc in laundry and kitchen is only temporary, slated for eventual ac operation. To generate this energy we needed steam at considerably higher pressure than our 100-psig top process need. So we selected 270 psig for our generating level, and hence our steam-boiler output.

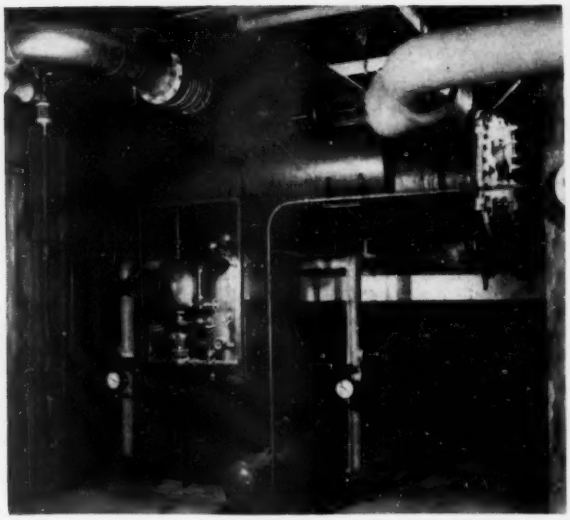
Boiler Selection. We picked two 30,000-lb-per-hr 270-psig 750-F steam generators, Fig. 2, to meet above steam needs. These units of 2-drum, bent-tube design now firing natural gas (and oil if needed) have their water-



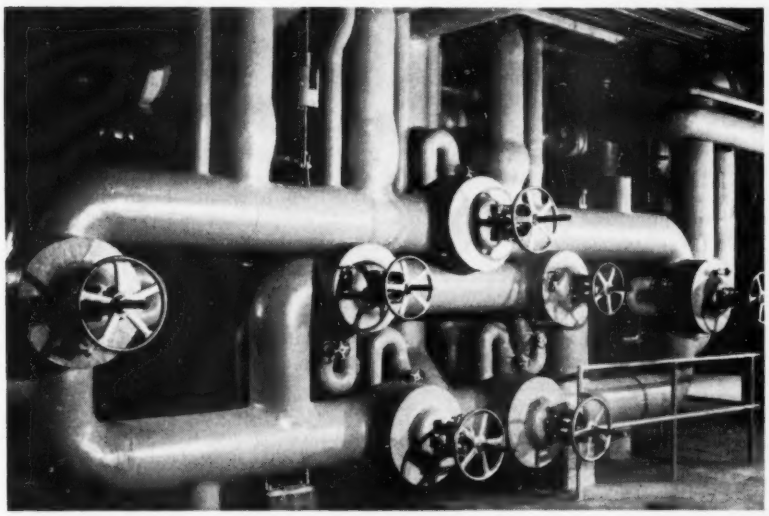
6 Flow diagram pictures the distribution of steam at the various pressure levels, indicates flexibility, balance that turbine exhaust and reducing stations give



2 Two selected boilers, 30,000 lb per hr, 270 psig, 750 F, have hung up 79.5% efficiency burning natural-gas fuel



3 High-pressure steam from boilers enters a manifold for distribution to power generators, pressure-reducing units



4 Single, condensing turbine unit, among three picked, employs a 2-pass non-divided waterbox surface condenser suspended from the turbine exhaust nozzle

5 Cooling tower, induced-draft-fan type, cools water for condensing unit, *left*

wall furnaces, forced- and induced-draft fans suitable for coal-firing on a traveling-grate spreader stoker should this equipment ever be needed.

Three combination oil-and-gas burners mount in a triangle on front wall of each boiler furnace. Natural gas from mid-continent fields reaches the plant at 25-40 psig, drops to 12 psig at gas-regulating house. Then as gas reaches each boiler its pressure drops still more through a regulating valve operated by combustion-control equipment. Boilers develop full-rated capacity with gas-burner pressure of 7 psig. Only fuel is natural gas except in winter when the outdoors stays under 5 below zero.

During this cold weather, fuel is No. 6 oil, stored in four 15,000-gal underground tanks some 75 ft from the boiler room. One motor- and one steam-driven pump, an oil heater, piping and accessories are all assembled on a common bedplate to deliver this oil from storage to the combination burners. These burners each carry a gas pilot fed from the domestic gas, making them safe from any service interruption. Oil-burner elements employ a wide-range mechanical atomizing design, handle oil at 275 psig, 210 F.

Tubular air preheaters furnish combustion air to the burners at top temperature of 335 F and corresponding minimum flue-gas temperature of 305 F. We have to use an auxiliary duct to bypass some combustion air to the air preheater outlet at low steam-generator loads so flue-gas temperatures do not get below the acceptable 305 F. A temperature regulator operates a damper to give an automatic control over the amount of bypassed combustion air. A motor-driven forced-draft fan with inlet vane dampers controls combustion air.

The induced-draft fan ties into a venturi stack that projects 12 ft above boiler-room roof. A steam turbine drives this fan through a reduction gear. A diaphragm valve in the steam-supply line picks up swings in steaming rates, sets off the proper accompanying changes in i-d fan speed.

Turbine-Generators. The 270-psig 750-

F steam, Fig. 6, feeds three 500-kw turbine-generators, Fig. 1, the i-d-fan drives, and two of the three boiler-feed pumps, plus the two major pressure-reducing stations, Fig. 7, operating in series for institution process and laundry needs.

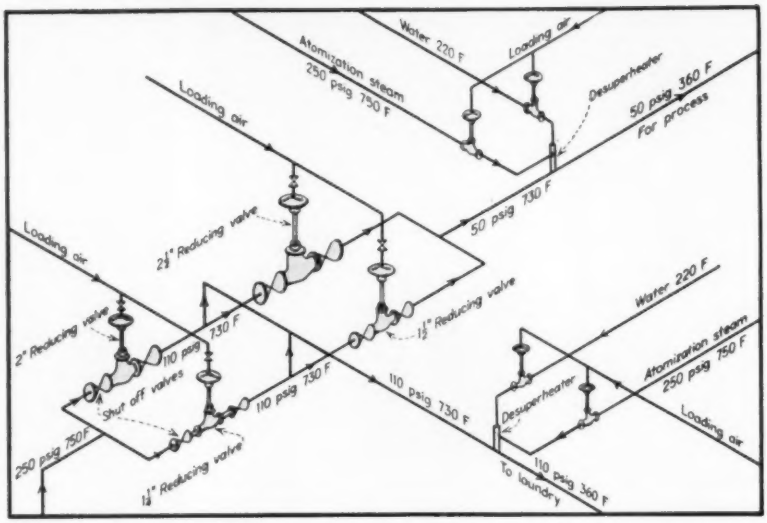
Two turbine-generators are noncondensing, one is condensing, with space for a later condensing unit. Turbines are all multistage (see equipment table, p 83) and multivalve design for throttle conditions of 250-psig pressure and 750-F temperature. The noncondensing units discharge directly into the 50-psig process header and the condensing unit into a surface condenser, Fig. 4, at 1 psia. An i-d cooling tower, Fig. 5, supplies the cooling water for the 2-pass, nondivided condenser.

Electric energy, generated at 2400 v, feeds into metal-clad switchgear onto the station bus for distribution. A double-ended indoor substation, 2400-480 v, supplies station power through two 300-kva transformers. A 2-section 480-v motor-control center contains breakers and motor starters for all power-plant motors. Station lighting comes from two 25-kva, 480-120/240-v, single-phase, 60-cycle transformers.

Daily peak electrical loads occur when laundry and kitchen stoves are on the line. Greatest loads develop in winter when heating-system ventilating fans add their demands to laundry and kitchen peaks. In spring and fall one condensing and one noncondensing turbine-generator in parallel balance process steam, electrical loads.

Power Auxiliaries. To get the desired reliability and continuity of services we installed duplicate power-plant auxiliaries, including turbine-driven auxiliary drives on equipment needed for emergency start-up. The i-d fan and its turbine drive, as mentioned, are built to give full-rated output under stoker and dust-collector operation.

Pressure-reducing stations, Fig. 7, employ two air-operated diaphragm-reducing valves in parallel with a single pressure controller. Smaller valve opens first, gives more accurate control during low-load flows. The two desuperheaters, jet design, use a small amount of high-pressure-steam fan atomization. Desuperheating water comes from boiler feedwater discharge headers under control of air-operated diaphram-type valves. Atomization steam is controlled in like fashion by the same type valve except it does not modulate for the different steam-flow rates. Pressure-reducing and desuperheater stations operate automatically with any instrument setting for desired pressure and temperature, or can be controlled manually from the centralized control panels.



7 Pressure-reducing stations have two air-operated reducing valves running in parallel with one pressure controller. Desuperheaters use atomized steam

Operation. Centralized control panels, just mentioned, stand on the operating floor for the steam- and electrical-generating equipment. They carry the necessary controls for these major elements, the pressure-reducing stations, building lighting, heating, ventilating and motor-driven auxiliaries. In addition, the boiler feed pump and feedwater piping system are operated on this same floor level. An annunciator notifies the 2-man crew of any irregularities.

With about a year and a half of operation under our belts results have proved good. All services—steam, electrical, energy, hot and cold water, compressed air—vary in demand from season to season and from hour to hour. The laundry, for example, pulls steam and electricity daily from 8:00 am to 4:00 pm except Sunday. During start-up the laundry takes a very heavy hot-water draw. When you add the heating season demands both boilers have to run to meet peaks. In summer at lowest loads one boiler alone can handle the demand at 50% of its rated output.

CORRECTION

In the article, "Hospitals Need Mechanical Know-How" (May POWER, pp 77-9) Tables I and II, columns 4 and 5 should both be labeled, "Power, Light & Heat Cost,"—not broken down as shown.

Steam-distribution mains, electric service, 110-F water from two hot-water storage tanks in the power plant, cold softened water from three zeolite water-softeners, compressed air and condensate return mains reach the major buildings through underground tunnels. These tunnels also serve for employe traffic and food transportation.

Troubles have been few, relatively light. At the start, condensate, returned from part of heating system, was contaminated with oil, which had accumulated from using steam engines in the old plant. This condensate we bypassed to the sewer the first few weeks, but now we filter it for feed.

In summer, the condensing turbine-generator meets the electrical energy needs. Exhaust steam from auxiliary-drive turbines, evaporators and pressure-reducing and desuperheating stations supplies 50-psig process steam.

This same condensing turbine plus one noncondensing unit takes care of the fall season load. Machines run in parallel and electrical load is proportioned by manual regulation of the turbine speeds on the switchboard, so nearly all 50-psig process steam comes from the noncondensing unit.

Winter, however, presents a different picture. The 50-psig steam load is greater than the electrical. Then the noncondensing turbines carry the electrical energy part of the load and provide some of 50-psig demand. Turbine-driven auxiliaries and evaporators meet remainder of this process-steam demand with pressure-reducing and desuperheating stations ready for makeup so the steam cycle is highly flexible.

PRINCIPAL POWER-PLANT EQUIPMENT

Rochester State Hospital, Rochester, Minn.

Steam-Generating Equipment:

Boilers, 2 ..... Wm Bros Boiler Mfg Co
30,000 lb per hr, 270 psig, 750 F, 2 drum, bent tube, 3953 sq ft boiler surface, 975 sq ft waterwall surface, 2100 cu ft furnace volume
Superheaters ..... Wm Bros Boiler Mfg Co
One per boiler, 3500 sq ft surface, two sections, tubular
Burners, 3 ..... Peabody Engineering Co
Combination, oil and gas, ring-type high pressure gas burners, mechanical-atomization oil burners
Setting ..... Plibrico Co
Monolithic refractory, insulation and steel casing
Induced-draft fans, 2 ..... Prat-Daniel Corp
Fan-stack type, one per boiler, 54,000 lb gas per hr, 8.4-in. wg
Induced-draft fan drives, 2 ..... De Laval Steam Turbine Co
Steam turbine, 40 hp, and reduction gear; 250 psig, 750-F inlet, 50-psig backpressure
Forced-draft fans, 2 ..... Clarage Fan Co
Vane controlled, inlet damper, 48,200-lb air per hr, 7.4-in. wg
Forced-draft fan drives, 2 ..... General Electric Co
Induction motor, 25 hp, 440 v, 3 phase, 60 cycle
Oil-pumping assembly ..... Leahy Mfg Co
Oil pump, 1, duplex, steam driven, 15 gpm ..... Worthington Corp
Oil pump, 1 ..... De Laval Steam Turbine Co
Screw type, motor driven, 15 gpm
Oil heater, 1 ..... Leahy Mfg Co
Blowdown tank, 1 } ..... Minneapolis Tank & Mfg Co
Flash tank, 1 }
Blowdown valves ..... Yarnall-Waring Co
Safety valves ..... Farris Engineering Corp
Steam purifier ..... Centrifix Corp
Meter, CO_2 ..... Permutit Co

Power-Generating Equipment:

Turbines, 3 ..... Worthington Corp
Two, 500 kw, noncondensing, axial flow, impulse type, 250 psig, 750 F, 5000 rpm, 5 valve, 6 stage, 50-psig backpressure; one, 500 kw, condensing 11 stage, 1-psia backpressure
Reduction gears, 930 hp, double-helical type ..... Worthington Corp
Generator, 1 ..... Electric Machinery Mfg Co
625 kva, 2400 v, 3 phase, 60 cycle, 1200 rpm, air cooled
Dc exciter, 1 ..... Electric Machinery Mfg Co
5 kv, direct-connected to generator shaft, 125-volt dc
Condenser, 1 ..... Condenser Service and Engrg Co
Two pass, surface type, 800 sq ft, tube length 12 ft; supported from turbine exhaust nozzle, twin-element 2-stage air ejector with inter- and after-condenser
Condensate pumps, 2 ..... Ingersoll-Rand Co
25 gpm, 1750 rpm, discharge head 125 ft, driven by 5-hp 440-v 3-phase 60-cycle induction motor
Cooling tower, 1 ..... Lilie-Hoffman Cooling Towers, Inc
Induced-draft type, capacity 1200 gpm, from 95 to 80 F; wet bulb 73 F, 2 fans, total capacity 220,000-cfm air, 318 rpm, each driven through Cleveland reduction gear by 15-hp 1750-rpm totally-enclosed fan-cooled 440-v 3-phase 60 cycle Louis Allis Co induction motor
Circulating-water pumps, 2 ..... Food Machinery & Chemical Corp
Horizontal centrifugal, capacity 1200 gpm, each 45-ft head, direct-connected to 20-hp, Ideal Electric Co, splash-proof, induction motor, 440 v, 3 phase, 60 cycle, 1750 rpm

Feedwater Equipment:

Deaerating heater, 1 ..... Worthington Corp
Tray type, flow capacity 70,000 lb per hr, storage capacity 6000 lb, heating section vertical with surface-type vent condenser, horizontal storage section
Boiler feed pumps, 2 ..... Warren Steam Pump Co
4-stage, horizontal, centrifugal pump; capacity, each unit, 90 gpm, discharge head, 970 ft, direct-connected to 40.5-hp steam turbine, 3550-rpm, 250-psig, 750-F backpressure, 50-psig, Whiton Machine Co
Boiler feed pump, 1 ..... Byron Jackson Co
10-stage, Hydroplex, vertical, centrifugal pump; capacity, 40 gpm; discharge head, 990 ft; direct-connected to 20-hp induction motor, 3600 rpm, 440 v, 3 phase, 60 cycle, Louis Allis Co.
Evaporators, 2 ..... The Sims Co
Horizontal submerged-tube, bundle capacity, each unit, 3500 lb per hr at 50 psig when supplied with steam at 250 psig, 750 F, and feedwater at 110 F, heating surface 100 sq ft
Evaporator feed pumps, 2 ..... Aurora Pump Co
Horizontal turbine type, capacity, each unit, 8.4 gpm, discharge head, 160 ft, suction head, 100 ft, direct-connected to ½-hp, 1750-rpm, Louis Allis Co, splashproof induction motor 440 v, 3 phase, 60 cycle
Condensate-transfer pumps, 2 ..... Food Machinery & Chemical Corp
Horizontal centrifugal, each 120 gpm, 201-ft head, direct-connected to 5-hp, 1750-rpm, Ideal Elect Co splashproof induction motor, 440 v, 3 phase, 60 cycle
Condensate-storage tank, 1 ..... Minneapolis Tank and Mfg Co
10 ft dia x 11 ft high, welded steel tank
Air compressors, 2 ..... Quincy Compressor Co
Two-stage capacity, each unit 92 cfm, 900 rpm, 90-100 psig, dual control for continuous or intermittent operation, driven with V-belt by 15-hp 1725-rpm induction motor, 440 v, 3 phase, 60 cycle
Air-receiver tanks, 2 ..... Moorhead Machinery & Boiler Co
36 in. dia x 8 ft high, ASME Code, welded steel tanks

Control & Metering Equipment:

Pressure-reducing stations ..... Republic Flow Meters Co
250-110 psig and 110-50 psig
Pressure-reducing stations, 50-6 psig ..... Fisher Governor Co
Desuperheater stations ..... Taylor Instrument Cos
Steam Flowmeters:
Steam generators ..... Bailey Meter Co
Turbine generators } ..... Republic Flow Meters Co
Process steam }
Gas-flow meters ..... Republic Flow Meters Co
Hot-water storage heaters ..... Leslie Co
Water meters ..... Worthington Corp
Oil meters ..... Worthington Corp
Pressure and temperature recorders:
Steam generators ..... Bailey Meter Co
Process steam ..... Republic Flow Meters Co

Electrical Equipment:

Metal-clad Switchgear, indoor ..... Westinghouse Electric Corp
5 kv, 2400 v, 3 phase, 3 wire, 60 cycle, 1200 amps, 3-pole, removable type
Control switchboard, duplex ..... Westinghouse Electric Corp
Tunnel type with all relays on rear
Circuit breakers ..... Westinghouse Electric Corp
Generator field, 250-v dc, nonautomatic, 2 pole, single throw
Power center, indoor: 600 kva, double ended ..... Westinghouse Elec Corp
Transformers: 300 kva, 3 phase, 60 cycle; high voltage, 2400, delta-connected; low-voltage, 480, delta-connected
Switchgear: low voltage, metal enclosed, 480 v, 3 phase, 3 wire, 60 cycle
Power breakers: removable, type DB-25, 600 v, 600 amp, 3 pole, single throw, 220-v ac, electrically operated with adjustable time overcurrent protection and instantaneous trip
Lighting breaker: removable type, 600 v, 100 amp
Indoor motor-control center ..... Westinghouse Electric Corp
Lighting panelboards ..... Westinghouse Electric Corp

Other Equipment:

Water softening ..... Water Softening Service Co
Sodium-zeolite-softener tanks, 3: 7 ft dia x 8 ft high, vertical, flow capacity of each 200 gpm, 70,000 gal between regenerations
Brine-measuring tank, 1: 36 in. dia x 48 in. high, vertical
Salt-storage tank, 1: 54 in. dia x 48 in. high, vertical
Salt-handling equipment ..... Jeffrey Mfg Co
One bucket elevator and screw conveyor, 7 tons per hr
Sump pumps ..... Aurora Pump Co
Duplex unit, each 100 gpm, 15-ft head, direct connected to 1-hp, 1750-rpm induction motors, 440 v, 3 phase, 60 cycle
Hot-water storage heaters, 2 ..... Minneapolis Tank & Mfg Co
5-ft-dia x 17-ft-long, horizontal, welded-steel tanks, submerged heating unit, each 48 sq ft heating surface, Bell & Gossett Co, flow capacity, 4000 gph, storage 2000 gal
Oil storage, 4 ..... Wm Bros Boiler & Mfg Co
11-ft-dia x 21-ft-long, horizontal, welded-steel tanks, submerged heating unit, Ross Heater Co
Ventilating fans, 3 ..... Westinghouse Elec Corp, Sturtevant Div
Axiflo duct-type fans, each 12,000 cfm at 70 F, 906 rpm, V-belt driven by 3-hp 1750-rpm induction motor, 440 v, 3 phase, 60 cycle
Heating units ..... McQuay, Inc
3 sections capable of raising temperature of air from −20 to 50 F when supplied with steam at 5 psig, 450 F
Filter bank ..... American Air Filter Co
Unit heaters ..... McQuay, Inc
Piping fabrication & erection ..... Reuben L Anderson Co
High-pressure valves ..... Wm Powell Co / Henry Vogt Machine Co
Low-pressure valves ..... Wm Powell Co
Welding fittings ..... Ladish Co
Expansion joints ..... Chicago Metal Hose Div, Flexonics Corp
Pressure-reducing valves ..... Fisher Governor Co
Flow-control valves ..... Minneapolis-Honeywell Regulator Co
Steam traps ..... Kaye & MacDonald, Inc
Safety valves ..... Farris Engrg Corp
Backpressure relief valve ..... Cochrane Corp
Atmospheric exhaust valve ..... Atwood Morrill Co
Drainers ..... Fisher Governor Co

Major Contractors:

Building ..... Benicke Co
Electrical ..... Southwest Electric Corp
Architects and Engineers ..... Ellerbe & Co

Here are Five Benefits From Installing Capacitors

1 Load power factor is improved

2 Current, carried by supply circuits and the equipment, is reduced. Or more power-producing current can be transmitted over the existing circuit

3 System losses are cut

4 Voltage drop in the supply circuits is cut

5 Monthly power bill may be reduced if the utility company has a pf clause

POWER-BILL SAVING tallied about $645 yearly after 60-kvar capacitor bank was installed. Unit, *tucked snugly in far corner*, boosted pf at service to more than 95%

Capacitors Pay Off Within First

Installing shunt capacitors in Cleveland department store's basement chopped pf penalty levied by local utility. Similar units may be the answer for overworked feeders in your plant

By **E W DOUGHERTY**, *Application Engineer, General Electric Co*

► Capacitors can pay big dividends and fast, as was the case at Halle Brothers Shaker Square store. The capacitor bank was installed in June 1950 with power factor hanging at about 72%.

A penalty clause of the local electric utility company, leveled against a demand of 147 kw per month, ran up a monthly penalty. Aim in installing the new capacitor bank was to raise pf to at least 95%. And by so doing the total in-pocket saving of penalty plus bonus amounted to about $645 yearly.

Location. Capacitors are connected in the power-distribution system adjacent to the central-distribution panel. They are set about 8 in. off the floor and fed through a 200-amp, fused, 3-pole safety switch tapped between the 600-amp main breaker and distribution breakers. Thus the main breaker kills power to all electrical equipment. The safety switch allows operation with or without capacitors.

Thought was given to installing individual capacitors at motor loads, but that plan didn't fit this setup. First off, cable runs between distribution and load were short. On top of that, cables in these runs were big enough to rule out benefits that might be reaped by reducing somewhat the ampere load through such feeders.

Capacitor Size. How did we arrive at the size capacitor needed for the desired pf improvement? As in all pf improvement, basic approach is through the right-triangle relationship of *true power* (kw), *reactive power* (kvar), *volt-amperes* (kva). Pf being cosine of the angle formed between volt-amperes and true power.

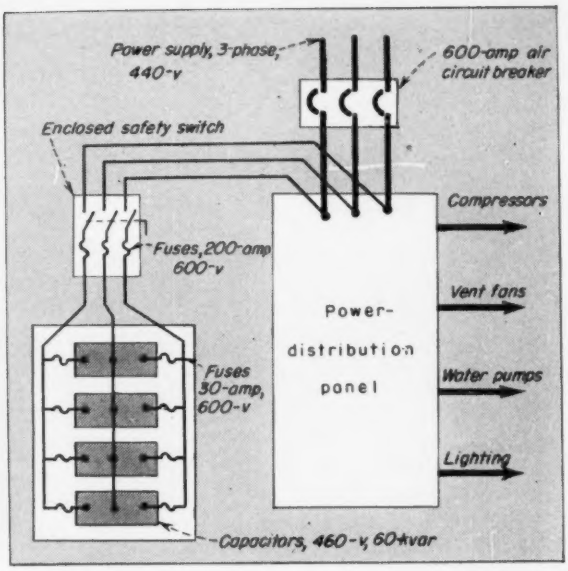
To determine size, knowledge of existing and desired pf is necessary. Here are the data collected and applied in our case. First off, metering is done on the main transformer's primary side. To get a representative picture of the power load a set of readings was tallied for three typical months. Then average of these three readings was used for calculations.

Here are the readings we came up with: 147 kwd, 71:6% pf, 29,600 kwhr, 28,500 kvar-hr. These figures represented readings taken over a period of 4.33 weeks, or 728 hr. Our desired pf was 95%, representing a pf angle of about 18 deg. Translating the desired pf condition into kvar-hr, we get kwhr $\times$ tangent of 18 deg. coming to 29,600 $\times$ 0.329, or 9720. This meant 28,500 $-$ 9720, or 18,780 kvar-hr that had to be removed by capacitors.

From here on, it was simply a matter of considering the reactive power taken by the transformers and figuring the average demand hours' use. The latter was determined by dividing the monthly kwhr by the kwd, or 29,600 $\div$ 147 $=$ 201. Then an experience factor is introduced. This factor of 1.25, multiplied by the average use-hours demand, gives a more accurate picture. So 201 $\times$ 1.25 $=$ 252 hr.

Total kvar-hr load figured out to be 8940. Taking this figure, dividing by

600-V FUSES tie in series between unit's incoming 440-v lines and individual capacitors; 3-pole switch ahead of the bank



CAPACITOR LOCATION at distribution panel rather than at load was best here since runs to loads were short and of ample size

Year Zooming Pf From 72 to 95%

252 hr, and adding in the transformer reactive loss yielded a figure of 52 kvar of capacitors needed. A 60-kvar unit was selected since that is the nearest standard size.

Following through on above, note that the advantage offered by a particular number of capacitors appears as the difference between total energy-cost reduction and installed cost of new equipment. By determining this difference throughout a range of installed capacitative kvar, we arrive at the most effective installation.

Switching Capacitors. Let us leave this installation and discuss capacitor applications in general. In some setups automatic or manual switching may be needed to meet supply or load conditions that change continually. An unswitched shunt capacitor can increase circuit voltage permanently, but its effect on regulation is negligible.

A switched capacitor, however, can be arranged both to increase voltage and decrease regulation. The usual unit used to initiate switching of capacitor banks is voltage, but any other quantity that can be measured in the circuit is a likely candidate for this control job. Type of control selected depends on the prime objective in an installation.

A capacitor bank is conveniently switched in steps. This calls for a minimum of extra equipment. Size of steps generally depends on the maximum change-in-voltage permitted at critical points on the system. Contactors or breakers in a switched bank must be selected with proper regard for the momentary currents and the interrupting duty imposed by a large concentration of capacitance. Equipment suitable for this type of duty is available, and no difficulties result if it is properly selected and applied.

Objectives of automatic switching may sometimes be more easily attained by manual switching of capacitors directly with the load, or by switching that is interlocked with the load. A limitation on switching capacitors directly with induction-motor loads has developed, making it necessary to limit capacitor size applied with a motor to less than 25% of motor kva.

If this limit is not respected the motor-capacitor combination, when disconnected from the supply circuit with the motor still rotating, may build up overvoltage by self-excitation in the local circuit formed in the motor reactance and connected capacitance. The setting of motor overcurrent devices should be rechecked after capacitors are connected directly at the motor terminals to correct for any reduction in the line current.

A workable combination for many plants is to install (1) a permissible and reasonable amount of capacitance along with individual loads, and (2) the required remainder as a partly switched capacitor bank at some convenient location on the distribution system. This plan results in installing maximum corrective kvar, with minimum auxiliary switching equipment.

More and more industrial plants are thinking in terms of secondary unit-substations as the most feasible spot for the location of the bulk of their capacitors. At this point capacitors benefit the primary distribution feeders by lowering their ampere load. Units may be automatically switched as a function of plant voltage.

Capacitors may be installed right on or near bus duct running throughout the plant. They may be tapped direct into bus duct through a set of fuses and disconnect switch. This technique fits well with the rapid growth of bus duct for secondary distribution in industrial plants. When so used, total capacitor kvar needed for a plant is split into several units. Then each unit is installed in a specific location where it does most good from both pf and reduced-amp angle.

CLEAN LINES, modern look of today's power stations, even the smaller ones like this 7500-kw Rocky Ford, Colo. plant, reflect sound engineering. But here's a plea for the same attention to detail for the station's cooling-water service

Bearings, Glands Need Clean Water Too

Station cooling-water services clog up from iron and solids

By **PAUL SNYDER,** *Chief Engineer, Rocky Ford Plant, Southern Colorado Power Co*

► As MORE POWER PLANTS go up in semiarid regions, a rather specialized water-conditioning problem for station water service is bound to crop up unless steps are taken at the design stage. At least that was our experience in the Rocky Ford, Colo. plant of the Southern Colorado Power Co after its 1951 start.

Here, we'd put in a 100,000-lb-per-hr 600-psig 825-F-total-temperature steam generator to supply a 7500-kw steam-turbine-driven generator. Makeup water for cooling tower, boiler and all station service-cooling needs came from two 900-ft-deep wells. These wells flow freely at about 10 gpm. So we set the pumps at 250 ft, and the two wells deliver 150 gpm.

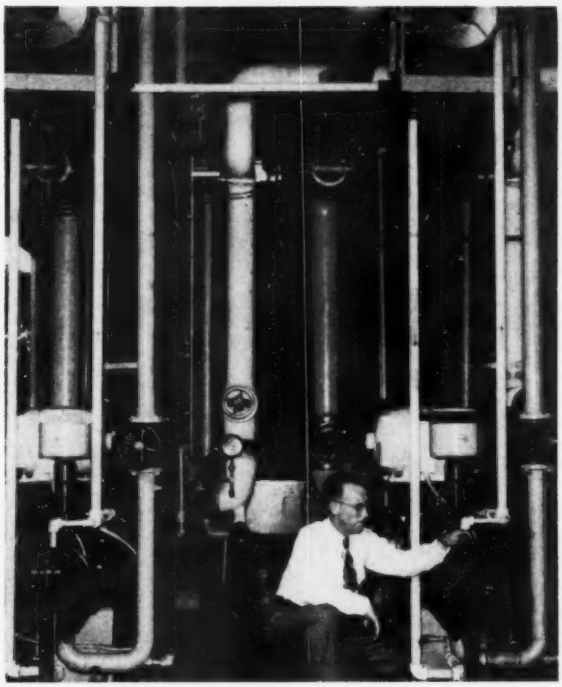
This well water shows a total hardness of 52 ppm as $CaCO_3$, a calcium hardness of 18 ppm, a magnesium hardness of 34 ppm, a zero phenolphthalein alkalinity and 208-ppm methyl-orange alkalinity, all expressed as $CaCO_3$. Chlorides, as NaCl, run 36 ppm; sulfates, as Na_2SO_4, 667 ppm; silica, as SiO_2, 11 ppm; phosphates show 0 ppm as PO_4. Total iron analyzes: 6.9 ppm, as Fe; carbon dioxide, 34.6 ppm; ammonia, as NH_3, 2.0 ppm; sulfide, as H_2S, 1.1 ppm; pH measures 7.0.

We started the plant off with a 4-in. standby connection to the city-water supply, which carries a total hardness of 250 ppm, as $CaCO_3$, in summer, and 600 ppm in winter.

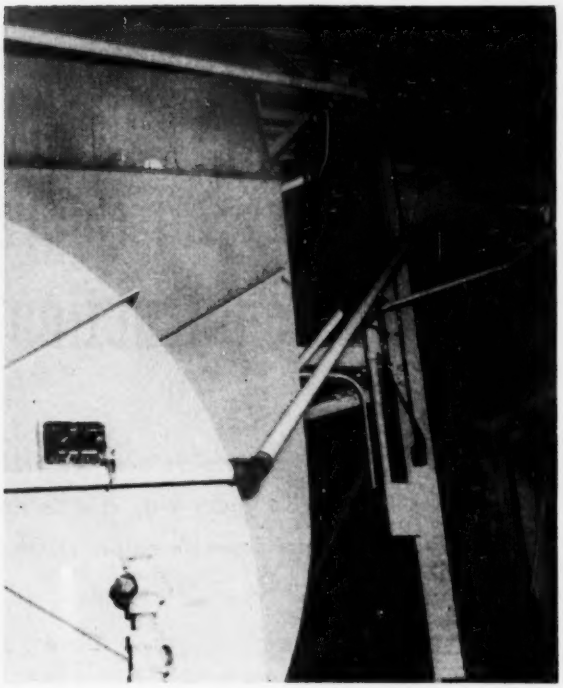
When well water is released to atmospheric pressure much of the carbon dioxide and hydrogen sulfide escape, so dissolved iron drops out of solution. This chain of reactions takes place especially where flow is not turbulent.

Our external water-conditioning system, employing one of the new synthetic zeolites, does an excellent job of removing total hardness, iron and ammonia. One thing we did find, though: To get rid of ammonia, we had to recharge the zeolite about three times as often as we would have for hardness salts alone. But our station cooling-water supply was a different story.

Flow rates to our water-cooled bearings, air-compressor jackets and boiler-



AIR-COMPRESSOR jackets, as well as pump gland-jackets and bearings, ran hot from badly clogged water service, *below*



SPECIAL copper-core fan-cooled radiators remove heat, picked up by cooling water in compressor jackets and fan bearings

MUD, IRON and insoluble scale in raw water, normally tapped for general station-service cooling needs, can become a service problem in the supply system, especially in semiarid regions where the cooling duty runs much heavier and longer

feed pump's gland-jackets ran very low and quiet. As a direct result, iron, dropping out of solution from the well water, as it neared atmospheric pressure in the connecting pipings or the water-cooled parts, filled them up from one-half to two-thirds of their volume within a single year, photos above.

We knew the answer, and so started the engineering and investigation of an aerator, followed by the cold-lime softening process for complete station satisfaction. But, in the meantime, we had a major problem on our hands.

To get the induced-draft fan's bearing-water-jackets, the air compressor's water-jackets and the boiler-feed pump's gland-jackets back to their start-up conditions, we cleaned them one at a time with inhibited muriatic acid.

Then we put in special copper-core fan-cooled radiators, top right photo, 8 ft above each air compressor and induced-draft fan's bearing near the outside wall. This way, each fan has an outside-air intake. Once in place, we tied these radiators into the equipment's cooling-water connections by 1½-in. pipe and hose fittings. Piping was laid out to give maximum circulation by thermal-siphon alone. The former cooling-water supply was cut off and condensate was put in the loop with 500 cc of potassium-dichromate rust inhibitor added. Makeup is nil.

Mercoid aquastats in the top tank of each radiator switch the fans on and off as circulating-water temperature requires.

The boiler-feed pump's packing glands now draw their cooling-water supply through one-inch copper piping that taps into the condenser-hotwell pump header. Discharge goes into the condensate stream just ahead of the low-pressure extraction heater. An automatic throttling valve on the hotwell level gives enough pressure differential for circulation through the glands.

With these changes we dropped our station water-cooling needs from 26 gpm to 1½ gpm. This last 1½ gpm comes from city water, which also supplies the zeolite-softened evaporator makeup.

HOW TO ORGANIZE YOUR NEW POWER PLANT – 2

Tips on Coordinating Station Construction and Start Ups

If future needs are not anticipated properly, getting a new station under way can be one long tale of woe. Here's some advice from an engineer who has followed up many such jobs

By D C SWIFT, *Ebasco Services Incorporated*

► COPIES of all new plant orders, specifications, instructions, design prints and letters should be sent to the plant operating superintendent promptly. Advising him of your plans in advance of actual construction helps him make suggestions or objections.

Superintendent's records are also more complete with this information. His files aid in settling questions that often arise during starting and testing. Besides they are valuable for future operation and maintenance.

Design Changes. Before and during construction, you are likely to discover a few items that must be changed to assure safe operation. And during construction other worthwhile improvements may become apparent that can be made without additional cost or delay.

Usually a job can be laid out a number of ways. Just because the design differs slightly from that most liked by operators, start-up men, service engineers and others is not always reason enough to warrant extensive changes.

Construction Requirements. Assuming proper design, the construction superintendent must build the plant, as designed, in a safe and workmanlike manner. He should do this promptly and at minimum cost to the owner. The manner of construction has a considerable effect on starting, testing and ultimate operation.

Items damaged during shipment or installation should be adequately repaired or else replaced. Faulty equipment causes trouble sooner or later, possibly at a time when a shutdown may be embarrassing and costly. Installed equipment should be clean, level and solidly set. All required connections should be in place and the moving elements lined up, cleaned and lubricated. Preferably, operators should assist in this work to become familiar with the new equipment. Take special pains that grease and debris, such as rags, bottles and welding rods, are not left inside of apparatus.

Construction Completion. It is usually uneconomical to completely finish a new project before placing it in operation. Set up the construction schedule to cause minimum interference with early operation. Locker rooms, floors, stairs and railings should be finished. Remove unnecessary scaffolding, and apply heat insulation where possible. Piping should have been carefully cleaned before erection, then hydrostatically tested and flushed with water or air to clean out refuse.

Well before starting date, expedite installation of instruments, small piping and miscellaneous electrical work, including control wiring and lighting. These items usually take longer than expected and are essential to safe operation.

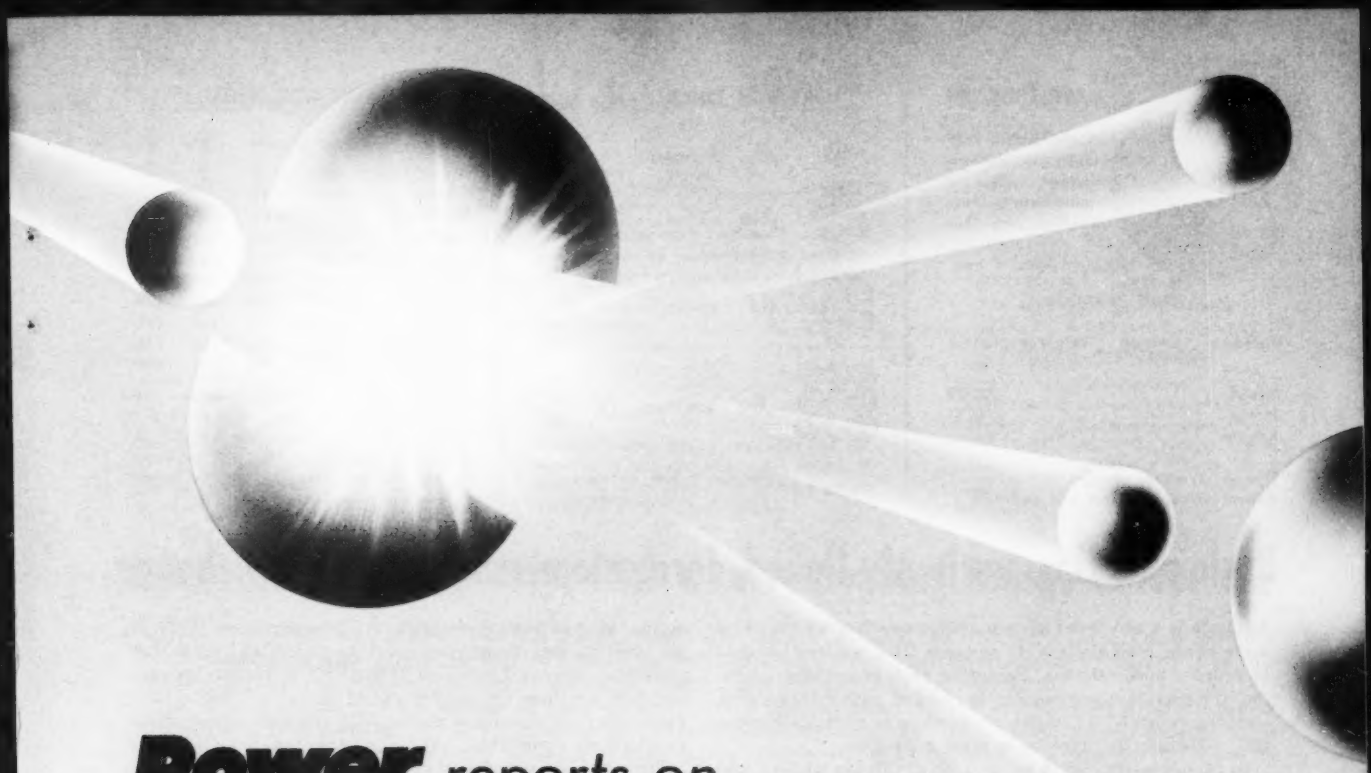
Start-up Coordination. A month to six weeks before the start-up date, hold conference of key operators, start-up men, contractors, manufacturers' representatives and construction men. A definite schedule for start-up activities with proposed dates for each step should be set up.

Request for service engineers of various manufacturers should be made far enough in advance to have them at the plant several days before start-up. This gives them time to look over the installation and make necessary changes before actual operation.

Construction to Operation. As each section of the plant is completed it should be turned over to the operators. Thereafter, let construction men do no work on that equipment without obtaining clearance from the operators. What to do and when should be clearly understood. In this way, you avoid accidents to personnel and damage.

Construction men should be excluded from operating areas after equipment is turned over to the operators, except where work items remain to be done. Any construction work in operating areas should cause minimum interference.

When extending an existing plant, it is advisable to install separating partitions to isolate dirt and noise of new construction work from operating sections of the plant. Shop, warehouse and toilet facilities for construction workers should be adequate so there is no need for these workers to be in operating areas. Occasionally, use of existing walks, stairs or elevators by construction personnel is necessary, but it should not interfere with operation.



Power *reports on*

ATOMIC ENERGY TODAY

Back in July 1940, long before Hiroshima made atomic energy a household term, POWER published a pioneer article, "Uranium 235 — Power Fuel of the Future?" It concluded, "Uranium 235 gives us the makings of atomic-power plants. In the light of the history of science and engineering, eventual application seems probable — perhaps within our lifetime."

Now, with atom research vastly accelerated by war and threat of war, we may see one or more large-scale plants delivering power by 1958, about 18 years after our quoted forecast. And at some later date, regarding which there can be no agreement today, atomic power may be truly commercial, holding its own in competition with familiar energy sources.

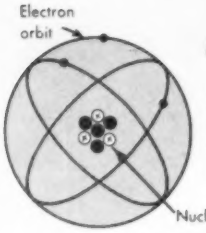
Whatever the date of truly commercial practicality, industry is ready and willing to carry development forward. Aware of this interest and desirous of stimulating industrial activity in this field, the Atomic Energy Commission has just released declassified portions of studies made by four industry teams. Given access to AEC data, engineer members of these teams examined the feasibility of designing, constructing and operating dual-purpose reactors to produce electric power and fissionable material.

For security reasons many details, particularly of reactor design, cannot be given. Yet here, for the first time, the "look" of practical atomic-power plants emerges — we see how the plants may be built, get some idea how much they may cost. We learn in what respects they will use conventional steam equipment and methods. And we glimpse some of the unusual ways they will differ from familiar practices.

As our condensations of these studies reveal, atomic power brings a new technology — one that power engineers must dig into and master. To make this as easy as possible, we preface the summaries of the engineering studies with our own boiled-down review of the facts of atomic fission.

Here, then, is what the busy engineer needs to know about atomic power today — fundamentals on which it rests, engineering proposals for actual plants, estimates of investment and operating costs.

JULY • 1953



ATOM STRUCTURE

Outer orbit is only 1/100,000,000 inch across; nucleus is ten thousand times smaller than that

BASIC PARTICLES

Particle	Charge	Weight (mass units) Approx	Exact
Neutron	0	1	1.00893
Proton	+1	1	1.00758
Electron	−1	1/1800	

One lb of matter contains 273 trillion trillion nucleons (protons and neutrons)

LIGHT-ATOM NUCLEI

		Protons	Neutrons	Nucleons
$_1H^1$	Hydrogen	1	0	1
$_2He^4$	Helium	2	2	4
$_3Li^7$	Lithium	3	4	7
$_4Be^9$	Beryllium	4	5	9

(Beyond helium, neutrons equal or exceed protons)

HEAVY-ATOM NUCLEI

Element	Isotope	Protons	Neutrons	Nucleons
Thorium	$_{90}Th^{232}$	90	142	232
Protactinium	$_{91}Pa^{231}$	91	140	231
Uranium	$_{92}U^{233}$	92	141	233
Uranium	$_{92}U^{235}$	92	143	235
Uranium	$_{92}U^{238}$	92	146	238
Neptunium	$_{93}Np^{239}$	93	146	239
Plutonium	$_{94}Pu^{239}$	94	145	239

Uranium 235 is completely defined as $_{92}U^{235}$ in which 92, atomic number of any uranium, indicates 92 protons and 235 is number of particles (protons plus neutrons) in this isotope. Also, 235 is the "mass number" of given isotope.

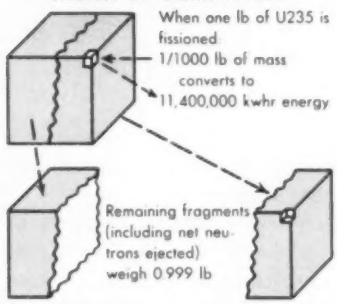
Basic particles, variously linked, form atom structures. Some change...

An atom is a tiny solar system, with more than 99.9% of its mass in the central "sun" or *nucleus*. This nucleus consists of *protons* and *neutrons*. Balancing each plus-charged proton in the nucleus is a negatively charged, rapidly revolving, *electron* "planet." Thus the whole atom is electrically neutral, although the nucleus is always positive.

In atomic energy work we deal only with the nucleus and commonly use the word "atom" to mean the nucleus. Two numbers identify any atom. Thus $_3Li^7$ means that *any* form of lithium has an atomic number of 3, because lithium atoms always have three protons. The *mass number* (7) is the total number of *nucleons* (protons plus neutrons) in this particular *isotope* (form) of lithium. If a lithium isotope had five neutrons its symbol would be $_3Li^8$. Tables above give data on some atoms, particularly the heavy ones, some of which are fissionable.

Natural radioactivity of certain heavy elements has long been known. Rate of disintegration is not affected by physical conditions or chemical action. Note in table above that radium is merely No. 7 in one radioactive series that started

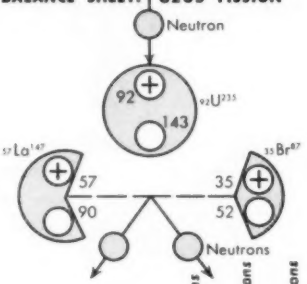
FISSION OF URANIUM 235


When one lb of U235 is fissioned
1/1000 lb of mass converts to 11,400,000 kwhr energy
Remaining fragments (including net neutrons ejected) weigh 0.999 lb

When U235 atom "splits", spare neutrons are ejected. These can, in turn, split other U235 atoms. If chain reaction continues until one lb is fissioned 1/1000 lb will be converted to energy

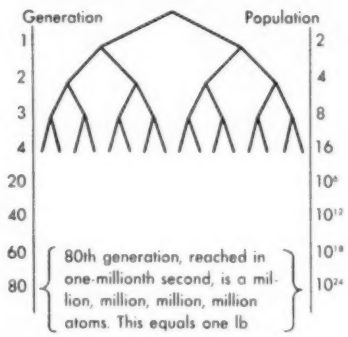
As shown in balance sheet *(right)* total particles after fission equal total before. Actual fission products and number of neutrons emitted vary from one fission to next

BALANCE SHEET: U235 FISSION



	Protons	Neutrons	Nucleons
BEFORE			
Impinging neutron		1	1
In U235	92	143	235
Total before fission	92	144	236
AFTER			
Larger fragment	57	90	147
Smaller fragment	35	52	87
Discharged neutrons		2	2
Total after fission	92	144	236

FAST (BOMB) CHAIN REACTION



Rate of growth for bomb with a reproduction factor of 2

When several pieces, each less than critical mass, come together quickly, chain reaction occurs at explosive speed until fragments separate enough to go below critical

"Splitting" heavy atoms yields vast energy and fission products...

Only fissionable substance found in nature is uranium 235, a rare form of natural uranium (one part U235 to 139 parts U238). When hit by a neutron, the U235 nucleus splits into two lighter atoms and ejects several (2.5 average) spare neutrons. These new-born neutrons can, in turn, split other U235 atoms. This *chain reaction* moves to completion with explosive speed in a bomb or gradually in a power reactor.

Whether fission be fast or slow, complete fission of any mass of U235 converts 1/1000 part of the mass into energy, according to the Einstein formula.

Uranium bombs use concentrated U235, extracted at great cost from natural uranium. Power reactors may use natural uranium, or natural uranium plus U235 or plutonium.

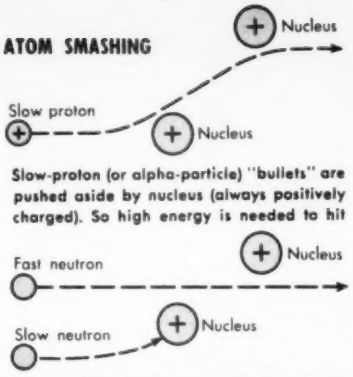
A lump of U235 smaller than a certain unrevealed *critical* mass will not maintain a chain reaction. This is because small pieces have more surface per unit of volume, hence let more neutrons escape without splitting atoms. The Smyth report states, vaguely, that the critical mass of pure U235 (a material much heavier than lead) is more than two lb and less than 200 lb.

URANIUM RADIOACTIVE SERIES

Element	Isotope	Radiation	Half life
Uranium	$_{92}U^{238}$	alpha	4.5 billion yr
Thorium	$_{90}Th^{234}$	beta	24 days
Protactinium	$_{91}Pa^{234}$	beta	1.14 minutes
Uranium	$_{92}U^{234}$	alpha	235,000 yr
Thorium	$_{90}Th^{230}$	alpha	80,000 yr
Radium	$_{88}Ra^{226}$	alpha	1620 yr
Radon	$_{86}Rn^{222}$	alpha	3.82 days

Alpha particle is a helium nucleus (2 protons and 2 neutrons). Alpha emission reduces mass number by 4 and atomic number by 2. *Beta* particle is an electron of negligible mass, so emission doesn't change mass number but raises atomic number by 1, changes neutron to proton.

ATOM SMASHING



Slow-proton (or alpha-particle) "bullets" are pushed aside by nucleus (always positively charged). So high energy is needed to hit

Neutron bullets, having no charge, are not repelled. If fast, they more often escape. If slow and closely aimed, they are trapped by powerful "adhesive" forces

MASS AND ENERGY INTERCHANGE

EINSTEIN: $E = MC^2$
where E = energy in ergs
M = converted mass, grams
C = velocity of light, cm/sec
= 30,000,000,000
So one gram = 900 quintillion ergs
one lb mass = 11.4 billion kwhr
= 39 trillion Btu
= 30 quadrillion ft lb
= 2.73×10^{25} mass units

ATOMIC CONVERSION

Shorthand formula below says helium "bullet" hitting nitrogen 14 knocks out hydrogen atom and leaves oxygen 17:

$$_2He^4 + {}_7N^{14} \rightarrow {}_8O^{17} + {}_1H^1$$

Protons	2	7	8	1
Neutrons	2	7	9	0
Nucleons	4	14	17	1

...naturally, or artificially, with a corresponding energy conversion

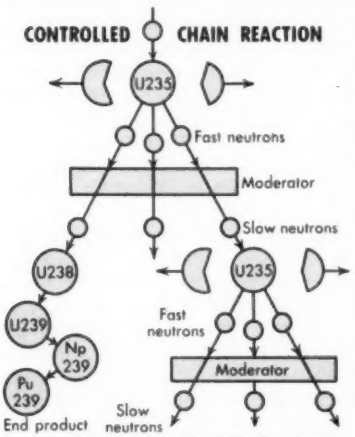
billions of years ago with uranium 238. *Half life* of a radioactive substance is time required for half the original weight to disintegrate into another nearby element or isotope. Half lives vary spectacularly from billions of years to a tiny fraction of a second. Thus it takes 4.5 billion years (table above) for half a given mass of U238 to change to thorium 234. Yet a given mass of Th234 takes only 24 days to change half itself to protactinium 234.

Artificial breakdown of atom structures is now carried out in "atom smashers." These hurl high-velocity particles at atomic nuclei. The "bullets" are charged particles (protons, electrons, helium nuclei, etc.) propelled by electric fields and steered by magnetic fields.

A neutron makes the best atomic bullet of all but cannot be directly accelerated in an atom smasher because it has no charge. But flying neutrons from exploded atoms are the sole means of propagating chain reactions in power reactors.

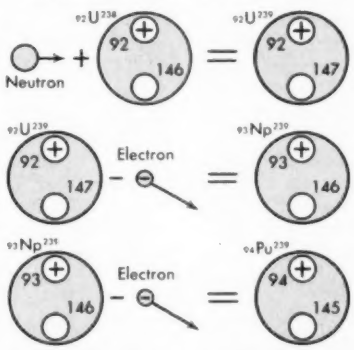
As given by Einstein's famous formula (above), a reduction in mass means a release of energy. Complete obliteration of one lb of matter would release 11.4 billion kwhr.

CONTROLLED CHAIN REACTION



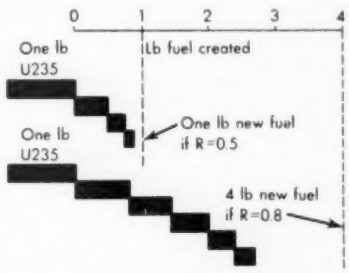
In natural-uranium reactor, "slow" neutrons split U235 atoms. Ejected fast neutrons are slowed by moderator, split other U235 atoms. Some neutrons are lost. Some, trapped by U238, start a chain ending with Pu

CONVERTING U238 TO PLUTONIUM



U238 captures neutron to become U239. In two steps, over several days, this decays to plutonium 239, equal to U235 as fuel. Note that electron ejection merely changes a neutron to a proton, doesn't change the number (239) of particles in the nucleus

ARITHMETIC OF BREEDING



R = Weight of Pu (plutonium) produced by "burning" one lb of U235 or Pu. If fuel produced is, in turn, burned to make more, and so on, theoretical total fuel produced is $R+R^2+R^3 \ldots = 1+(1-R)-1$

Example: With reproduction rate (R) of 0.5, one lb of U235 makes one lb of new fuel. If R were 0.8, new fuel made would be 4 lb

...How fission occurs decides whether we have a bomb or a reactor

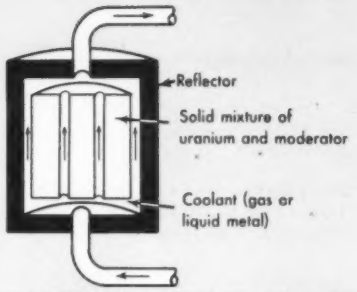
An atom bomb contains much more than the critical mass divided into several pieces, each less than critical. When these are brought together at high speed, a chain reaction occurs at explosive speed until fragments separate far enough to bring remaining mass below critical level.

Critical mass of natural uranium is infinite, so a natural-uranium reactor can't work without addition of something to boost effectiveness of highly diluted U235. *Moderators* do this by slowing down neutrons through multiple collisions. Slow neutrons are easily captured by nuclei, so make far more "hits." Low speed is enough to split loosely bound U235 atoms. Typical moderators are graphite, heavy water.

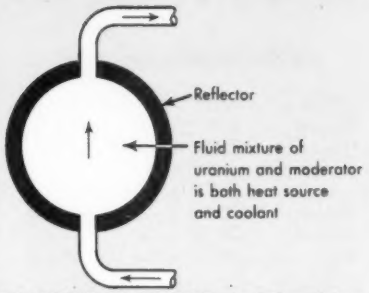
In any reactor containing U238 (usually many U238 atoms for each U235 atom) some flying neutrons will be captured by U238 atoms and will convert them by steps (see above) to plutonium. This can be separated chemically and used as a fissionable nuclear fuel equal to U235. Thus, indirectly, we can "burn" not only costly U235 but a substantial part of the plentiful U238. "Breeding," as outlined above, offers the possibility of burning the whole mass.

FIVE REACTOR COMBINATIONS

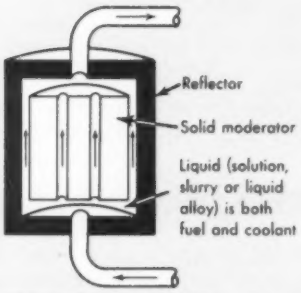
Nuclear fuel, moderator, fertile material and heat-transfer fluid may be combined in various ways. *Homogeneous* reactors have fuel and moderator mixed. They are separate in *heterogeneous* units



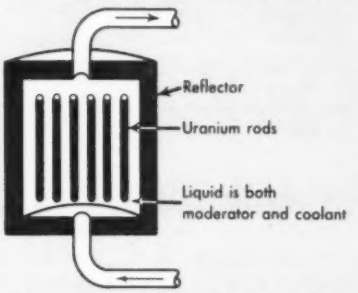
HOMOGENEOUS REACTOR has solid mixture of uranium and moderator, coolant circulates



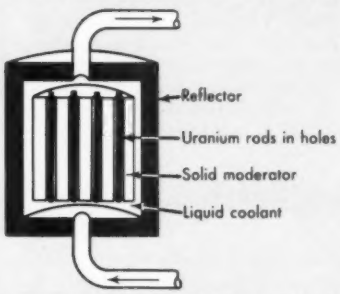
HOMOGENEOUS REACTOR: circulating mixture of fuel and moderator acts also as coolant



HETEROGENEOUS REACTOR: solid moderator; liquid fuel is both heat source and coolant



HETEROGENEOUS REACTOR uses solid fuel, liquid moderator serves also as a coolant



HETEROGENEOUS REACTOR has uranium slugs or rods in solid moderator, separate coolant

Reactors—nuclear "furnaces"—raise new questions: What fuels . . .

Every reactor must contain nuclear fuel (normally U235 or Pu239), usually with a "moderator" to slow down the neutrons. A power reactor must also circulate a heat-transfer fluid (coolant) from reactor to steam generator. Shown above, in schematic form, are five basic arrangements of fuel, moderator and coolant. In addition, many reactors contain "fertile" material, which reactor operation converts to new fuel.

Reactors may be classified either by *purpose* or by *neutron speed*. We have reactors for *power* only, for new fuel *production* only, or both. A production reactor, efficient enough to generate one pound, or more, of new fuel (from fertile material) for each pound of fuel consumed, is called a "breeder." *Fast-neutron* reactors use the fuel in concentrated form, use little or no moderator, and run at a high heat-release rate. Reactors using highly diluted fuel, such as natural uranium, must employ large masses of moderator and are *slow-neutron* ("thermal" neutron) reactors.

Fuels and Moderators. As shown at lower left, there is but one "natural" atomic fuel, U235, as well as two known artificial fuels, Pu239 and U233. The two known fertile materials are U238 and Th232. The primary fuel, U235 (1/140 part of natural uranium), can be separated from its associated U238 by the gaseous-diffusion process (Oak Ridge). Because of the very high cost of this separation most commercial reactors now planned will use either natural uranium alone or enriched with U235 or Pu239.

Moderator Compared. The billiard-ball analogy (below) shows why only light atoms are effective moderators. Two other requirements are: Moderator (1) must be a liquid or solid (gases are too thin) and (2) must not be excessively wasteful in capturing neutrons (they should bounce off, not get trapped by the moderator's atoms).

Ordinary hydrogen in liquid form (water) is a fair moderator, but too wasteful of neutrons. Heavy hydrogen, $_1H^2$, in heavy water, does not capture neutrons, and so is a first-

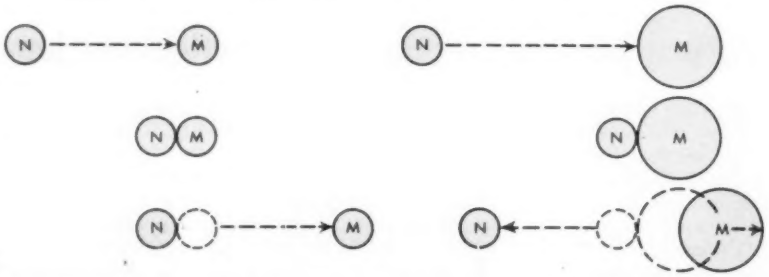
FISSIONABLE MATERIALS

URANIUM 235 ($_{92}U^{235}$) is 1/140 part of natural uranium.
PLUTONIUM 239 ($_{94}Pu^{239}$) is not found in nature but is produced in reactor when neutrons are captured by uranium 238 ($_{92}U^{238}$)
URANIUM 233 ($_{92}U^{233}$) is also produced artificially in reactor when neutrons are captured by thorium 232 ($_{90}Th^{232}$).

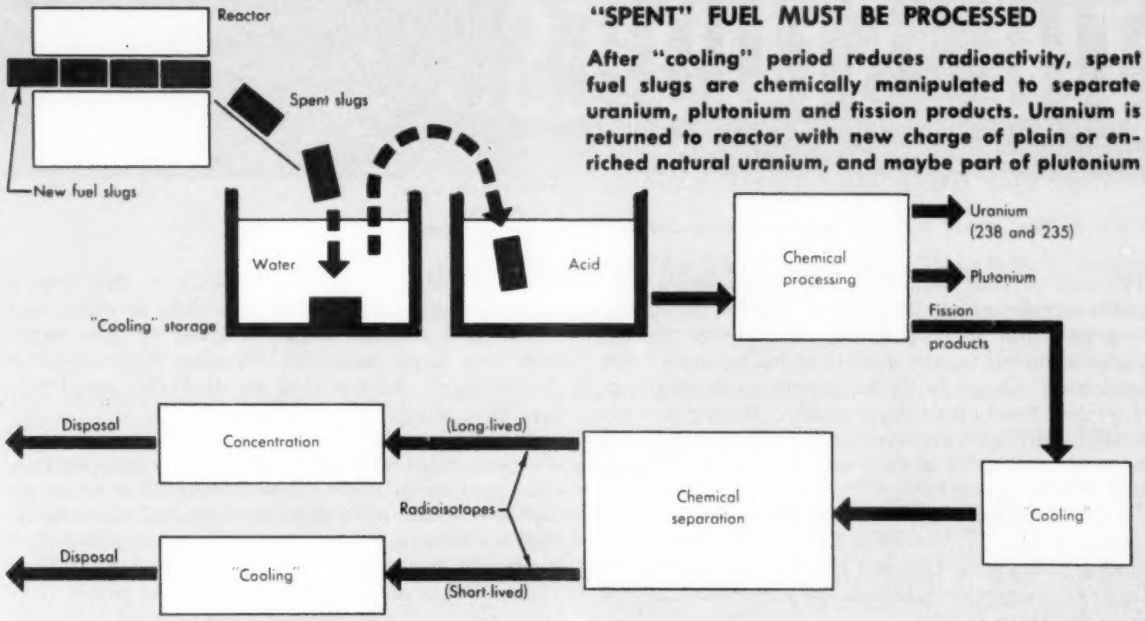
FERTILE MATERIALS

This term describes elements that can be converted into fissionable materials such as U238 (converts to plutonium 239) and thorium 232 (converts to U233). (See above.)

WHY LIGHT MODERATORS ARE BETTER THAN HEAVY



Perfect moderator, with same mass as neutron, would stop neutron in one head-on collision, as in billiards, but heavy moderator nucleus bounces neutron back, as shown



"SPENT" FUEL MUST BE PROCESSED

After "cooling" period reduces radioactivity, spent fuel slugs are chemically manipulated to separate uranium, plutonium and fission products. Uranium is returned to reactor with new charge of plain or enriched natural uranium, and maybe part of plutonium

. . . moderators, coolants, control, shielding, processing of spent fuel?

class moderator—also very expensive. Helium won't do because it forms no liquid or solid compounds. Lithium and boron can't be used; they capture neutrons. That leaves carbon and the costly beryllium, both good moderators.

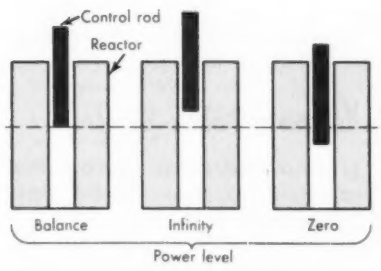
Coolants. Favored coolants are ordinary water, heavy water (serving also as moderator), molten sodium or molten sodium-potassium alloy. Helium is another possibility. Water is perfect for heat removal, but puts a low ceiling on steam pressure. The sodium and potassium are almost perfect except for handling hazards. If a leak brings water and sodium together, they react violently. Designers feel they can provide needed safeguards. The only objection to helium is its low density, even when used under pressure.

Processing. Whether the fuel is fissioned in solid or liquid form, it must be processed at intervals to remove the accumulated fission products (split atoms) and excess plutonium. The remaining U235 and U238, plus fresh charge as needed, are returned to the pile. Processing is a major problem, since the highly radioactive fuel slugs and fission products must be handled by remote control.

Control. The reactor must contain slightly more than the critical mass of fuel. The value of this mass varies greatly with fuel concentration, kind and amount of moderator, and shape of the reactor. In operation the effective mass is held down to exactly critical level by adjusting insertion depth of rods made of some neutron-absorbing metal, such as boron. Control is possible only because ¾ percent of neutrons are delayed for many seconds. This gives rods time to act if reproduction factor is kept below 1.0075 (the runaway point).

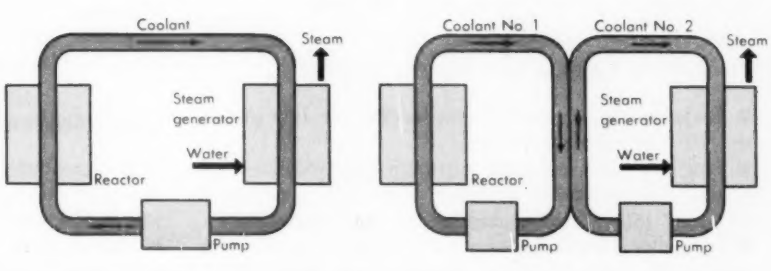
Shielding. The entire reactor and often the primary coolant circuits must be heavily shielded with concrete several feet thick (or with equivalent in other materials) to protect operators from the gamma and other deadly radiations. Shielding will weigh not less than 50 tons for the smallest and most compact reactor.

CONTROL IS DELICATE



Control rod must hold reproduction rate at unity to keep reactor from "running away"

SINGLE AND DOUBLE COOLANT CIRCUITS ARE USED



Single coolant circuit usually permits lower temperature drop. With sodium or sodium-potassium coolant, double circuit reduces hazard; only first circuit needs shielding

THE STUDIES

Why they were made, what they cover, thumbnail guides to detailed summaries that follow

Although private industry, under government contract, has been taking part in the atomic-energy program from its beginnings, the Atomic Energy Commission has sought ways in which industry could participate independently for maximum development of nuclear fission for human welfare. By the summer of 1951, AEC had arranged with four groups of two firms each to make, at their own expense, initial surveys of reactor technology.

These four groups were: Dow Chemical Co and Detroit Edison Co; Monsanto Chemical Co and Union Electric Co; Pacific Gas and Electric Co and Bechtel Corp; Commonwealth Edison Co and Public Service Co of Northern Illinois.

The "teams" independently agreed with AEC to: (1) determine the engineering feasibility of their designing, constructing and operating dual-purpose reactors to produce fissionable material and power (2) examine economic and technical aspects of building such reactors in the next few years (3) determine the possible research and development needed (4) recommend industry's role in designing, building and operating such reactors. To members of these teams, AEC made available pertinent data and research results.

To bring as much information as possible to interested industrial firms and engineers, the reports submitted by the study groups were screened and declassified versions prepared. These are now available in a single pamphlet, "Nuclear Power Reactor Technology" (Supt of Documents, U. S. Govt Printing Office, Washington 25, D.C.; 25¢)

In the pages that follow, you'll find the essence of the declassified material, streamlined for easy reading.

In reading the reports, bear in mind that, for security reasons, they're fragmentary—lacking, particularly, detailed data on reactor design. Also, the teams were instructed to consider dual-purpose reactors. Thus proposals are not necessarily those that would have been made if the studies had been directed to power-only reactors with plutonium produced having value only as fuel. Finally, the proposals are conditioned by the requirement that designs be such as might be built in the next few years.

While the proposals differ in regard to reactor designs, all teams concur in the belief that dual-purpose reactors are technically feasible and could be operated so the plutonium credit would reduce cost of power. Conversely, all agree that no reactor that could be built in the very near future would be economical on the basis of power generation alone.

IN BRIEF: Four approaches to atomic power

Dow Chemical—Detroit Edison

- Sodium-cooled fast breeder reactors give low fuel cost and high coolant temperature for efficient power production. This team concentrated on them.
- Simplified solid fuel elements get nod in design now under way, but aim is more "mobile" fuels, even fluids, for easier handling and reprocessing.
- Five reactor arrangements briefly itemized use solid, slurry and liquid fuels, vary from 7500 to 138,000-kw electrical output at 30% thermal efficiency.

Monsanto Chemical—Union Electric

- Sodium-cooled graphite-moderated reactors of two similar designs were studied:
- One has 1000-mw heat output. Using sodium temperature range of 650 to 300 F generates 3 million lb per hr of 150-psia saturated steam, 208,000 kw net.
- For other reactor (3000 mw) two power cycles were considered: (1) using full temperature range of sodium (900 to 300 F) generates 8.8 million lb per hr of 400-psia 746-F steam, gives 834,000 kw net output (2) rejecting heat of sodium below 500 F evaporates 4.8 million lb per hr, gives 554,000 kw net.

Pacific Gas and Electric—Bechtel

- Water-cooled thermal reactor and sodium-cooled fast reactor, both 500-mw heat output, were studied:
- Water-cooled reactor, with heavy-water moderator, develops 100,600 kw net, using 175 psia 378-F steam.
- Sodium-cooled reactor is much smaller physically, generates 1,600,000 lb per hr of 500-psia 750-F steam. Net electrical output is 145,300 kw.

Commonwealth Edison—Public Service

- Helium-cooled graphite-moderated reactor has 350-mw heat output, generates steam at 265 psia, 525 F. Net electrical capacity is 46,700 kw.
- Heavy-water-cooled, heavy-water-moderated reactor has 1064-mw heat output. Turbines operate on 180-psia saturated steam, develop 211,500-kw net.

Dow Chemical – Detroit Edison

Liquid-metal-cooled fast-neutron breeder reactor with fuel elements of solid uranium, under design by this team, offers high coolant temperatures for steam generation. They look to future reactors using liquid-metal fuel with continuous reprocessing

Dow Chemical–Detroit Edison studies aimed to obtain as many desirable characteristics as possible, using materials, processes and designs now existing in partly developed form. This led to concentration on a liquid-metal-cooled fast-neutron breeder reactor.

This type gives high coolant temperature needed for efficient power recovery. Fuel elements will be uranium alloy in solid form. It is planned to use uranium in the breeder blanket as fertile material for making plutonium.

Economical power reactors, in Dow-Detroit thinking, must meet these important specifications:

1. Use low-cost fuel: that is, be a breeder reactor that (within itself) converts thorium or depleted uranium to fissionable material. Throughout this report, "breeder reactor" means one that produces more fuel than it burns.
2. Reactor should be of fast-neutron type to produce an excess of fissionable material above its own needs.
3. Reactor should operate at high temperature. Core temperature of 950 to 1100 F may be possible.
4. Design should permit integration with a variation of improved extraction processes now under study at Ames and Brookhaven.
5. Unit should require minimum "exclusion area" (segregated area specified for public safety). Exclusion area can be minimized by continuous removal and segregation of fission products.
6. Reactor should use uncanned fuel, preferably mobile or fluid.
7. Reactor should be inherently self-regulating.

Operating Temperatures. Both power level of a reactor and rate of plutonium production parallel heat removal. More heat can be removed by lower coolant temperature, but production of economical power requires a relatively hot coolant. For a reactor to produce both power and fissionable material economically, fuel elements must be designed to operate at temperatures high enough so production of plutonium or other fissionable material will not be limited by power-generating requirements.

Commercial future for atomic power appears to depend on development of breeder reactors. Sale of surplus fissionable material will help offset high capital and processing costs, significant fuel costs of nuclear plants.

Process Integration. Use of liquid fuel, and closer integration of the reactor with the separation and decontamination processes, will reduce costs. Molten-metal processes may be developed into a superior separation method. This would be more compatible with present reactors and much cheaper than the aqueous (water-solution) processes. For one thing, it would avoid machining and jacketing fuel slugs.

Mobile fuels facilitate frequent and rapid processing. Also, a closely integrated processing system must be provided to recover pure plutonium and remove "hot" fission products. These aims can be achieved by the system outlined above. So most desirable fuel is one that can be liquid at all times.

If a solid fuel is necessary, then fuel elements must be so easily formed that they can be fabricated by remote control. Fuel elements cast from molten metal should meet this need.

Fluid fuels that can be considered for future development include:

1. *Eutectics* of uranium or of plutonium with melting points approxi-

I—Data on Five Proposed Reactor Arrangements Using Sodium Cooling

	A-1 *Radiator: liquid fuel, liquid coolant*	A-2 *Radiator: slurry fuel, liquid coolant*	A-3 *Radiator: liquid fuel, solid fertile material, liquid coolant*	B *Radiator: solid fuel, liquid coolant*	C *Liquid-liquid: liquid fuel, liquid coolant*
Maximum heat output, kw	25,000	460,000	75,000	450,000	220,000
Max coolant temp for steam generation, F	900	1020	900	1020	930
Electrical output at 30% efficiency, kw	7500	138,000	22,500	135,000	66,000
Coolant material:	Sodium*	Sodium	Sodium	Sodium	Sodium
Max circulating velocity, fps	30	30	10 (30)	30	30
Temperature rise, C	130 (260)	130	140	280	300
Max temperature, C	480 (610)	480	480	550	500
Min temperature, C	350	350	340	270	200
Limiting factors on specific power	High heat release per unit volume in fuel requires very small fuel elements or large temperature drops	dc_p of coolant	High heat release per unit volume in fuel requires very small fuel elements or large temperature drops	dc_p of coolant	dc_p of coolant
Max coolant temperature limited by:	Corrosion	Corrosion	Corrosion	Corrosion	Corrosion

*Melting temperature, 98 C; boiling temperature, 883 C; thermal conductivity, 0.15 cal/cm/sec/C; density times specific heat (dc_p), 0.24 cal/cm³

mately 500-C temperature and higher.

2. *Slurries*, such as dispersions of inter-metallic compounds or alloys of uranium in low-melting-point alloys.

3. *Fused salts*.

To postpone the need for solving many problems of fluid fuels, solid fuel is preferred choice at present. Yet some of the advantages of fluid fuels can be gained through the use of relatively low-melting materials even though in solid form. Uranium alloy is a reasonable choice for the original effort.

Exclusion Area. Present safety rules require a very large exclusion area around an atomic plant. Thus, to build a reactor within the distribution territory of the Detroit Edison Co. would cost, per kw for land alone, 50% of present steam-plant cost. For the first few reactors built this may be a critical factor in total cost.

One way out would be to locate the reactor offshore in a body of water close to the distribution territory. Reactor and appurtenances could be installed on a barge or ship, floated to location and sunk in shallow water, or anchored there. Steel tanks, filled with sand and water, would provide shielding. Initially only the reactor with its integrated separation facilities would be built, to hold down first costs. Heat produced can be readily "dumped" in such a spot. Electrical generation and transmission facilities could be added later.

Reactor Types. Table I gives data on mechanical arrangements, which might meet all or part of the desired requirements listed previously:

1. A jet-mixed centrifugally separated liquid-cooled unit with liquid fuel, continuous processing (*C* in table).

2. A design with liquid fuel contained in reactor "pot," with coolant in tubes, (*A-1* in table).

3. Coolant outside fuel tubes with liquid or mobile fuel inside tubes, with or without fast, continuous processing.

Column *B* in table outlines first design to be investigated. It uses a uranium alloy in solid form. This type promises to provide many of the needed characteristics and should be capable of quite early development.

Future Reactors. The ultimate objective (*C* in table) should be a fast reactor with a true fluid fuel. It would include metallurgical processing and would not have conventional heat-transfer surfaces. It might be built of refractory materials that would be reasonably good for either thermal (slow) or high-energy neutrons. The core would be all molten metal.

Fertile material (that is, convertible into fissionable material) might be either depleted uranium or thorium, depending on product desired.

Another basically simple type of mobile fuel reactor is one in which a pot of molten fuel is cooled by coolant flowing through it in tubes or metal shells (so-called "radiator" type). Here the container material becomes a critical problem. In table, *A-1*, *A-2* and *A-3* are variations of this.

Type *B* is a variation in which fuel flows in and out of pot in a molten state, but is held as a solid at a somewhat lower temperature during most of its stay in the reactor.

Monsanto Chemical – Union Electric

As a first step, these companies favor a sodium-cooled graphite-moderated slow-neutron reactor using natural uranium. For each of two reactor layouts, varying in detail, their report compares power cycles using the heat output in different ways

The Monsanto Chemical–Union Electric team was asked to study the feasibility of a reactor to produce both plutonium and power—one that could be built within the next few years. Studies assumed production of military plutonium for five years. After that, plant would be run for power alone. Table I summarizes characteristics of two similar reactors considered.

Hanford reactors gave a starting point of experience to speed design and construction. Because water as a coolant in a Hanford reactor would not permit high-enough temperature for economical power production, sodium was chosen. Sodium at low pressure can remove more heat than pressurized water. Also, it does not corrode stainless steel up to 900 F or higher. As plutonium production is nearly proportional to heat output, sodium coolant permits making more plutonium from a given size reactor.

First-Choice Reactor. For this sodium-cooled and graphite-moderated design, metallic uranium was chosen because it minimizes enrichment required and this material is relatively well known. A maximum uranium temperature of 1100 F was chosen to leave a margin of safety. Two potential designs were arrived at. Both have the same general arrangement but differ in the coolant systems and techniques of loading and unloading (see table).

Moderator and surrounding 2-ft-thick reflector is assembled from graphite blocks to form an octagonal prism 24 ft high by 29 ft across the flats. Cooling-channel holes are spaced in a square lattice. Tubular fuel elements, placed in holes by a suitable loading mechanism, are cooled by sodium flowing both through and around them.

Hot sodium flows through heat exchanger and is then pumped back to reactor. Special protection prevents sodium vapor from diffusing into graphite, spots sodium leaks, and cools graphite.

Fuel channels can be loaded and unloaded while running at full load. After a few days "cooling," irradiated fuel assemblies moved from the reactor are transferred to lead shipping "coffins" with 12-in. walls. All fuel handling equipment is remote controlled.

Studies indicate that the most economical plutonium-power reactor uses enriched fuel. Cost of enriching is more than offset by resulting production of more plutonium, lower unit cost.

Coolant Circuits. To prevent contact and resulting violent reaction between sodium and water, shell-and-tube heat

I—Characteristics of Sodium-Cooled Graphite Reactors

	Case A	Case B
Purpose	Plutonium and power	Plutonium and power
Neutron energy	Thermal (slow)	Thermal (slow)
Heat output, mw	1000	3000
Materials and amounts:		
Percent enrichment of U235	0.83	0.95
Amount of uranium, kg	214,000	214,000
Fuel elements	Internal cooled tubes	Internal, external cooled tubes
Moderator	Graphite	Graphite
Reflector	Graphite	Graphite
Shield	Concrete	Concrete
Primary coolant	Sodium	Sodium
Fertile material	U238	U238
Fuel: max uranium temp, F	1100	1100
Coolant		
Inlet temperature, F	300	300
Outlet temperature, F	650	900
Maximum velocity, fps	20	20
Gpm at 300 F	70,000	120,000
Cfm at 300 F	9000	16,000
Pumping power (50% eff), kw	3000	5000
Dimensions:		
Core	Octagonal prism 20 ft high, 35 ft across flats	Octagonal prism, 20 ft high, 35 ft across flats
Reflector thickness, ft	2	2

II—Estimated Electric Power Costs

	Case A		Case B		Modern steam plant	
Capital costs, $10⁶	26		61		44	
Net output, kw	210,000		554,000*		260,000	
Cost, $/kw	124		110		169	
	$10⁶/yr	Mills/kwhr	$10⁶/yr	Mills/kwhr	$10⁶/yr	Mills/kwhr
Depreciation**	5.20	3.30	12.20	2.94	1.26	0.65
Property taxes, insurance	0.52	0.33	1.22	0.29	0.88	0.45
Fuel cost (coal @ 23¢/10⁶ Btu)	0.0	0.0	0.0	0.0	4.63	2.37
Operating cost	0.79	0.50	2.10	0.50	0.98	0.50
Total	6.51	4.13	15.54	3.73	7.75	3.97

Assumptions: Plutonium sale offsets all fuel costs; operating time, 7500 hr/yr; taxes, insurance, 2%; depreciation, 20%. *Heat rejected below 500 F. **20% on cases A, B; 2.86% for coal plant

exchanger would have double concentric tubes with mercury-filled barrier space between. Safety hazards of sodium leaks, and radioactivity of sodium in the recirculating system, require that entire sodium circuit be completely leaktight.

Fortunately, valve stems can be sealed by double bellows with a leak detector between bellows to show failure of the first line of defense.

For pump shafts, the literature suggests such possibilities as canned rotators, floating shafts, canned motors, frozen seals, etc. But the only completely leakproof pump developed to date is the electromagnetic type. It is assumed it will be used for any plant planned in the immediate future.

The sodium-to-water heat exchanger, and sodium pumps and piping, must be shielded for gamma radiation, preferably each unit separately protected.

Internal Cooling. Power cycle for *Case A*, Table I, is based on receiving sodium from the reactor at 650 F and returning it at 300 F. Heat exchangers generate 3 million lb per hr of dry saturated steam at 150 psi. Turbine cycle has a gross thermal efficiency of about 22%. Electrical output is about 220 mw from two units. Auxiliary power totals about 5.5% of gross capability.

Such a bulky low-pressure turbine-generator is a far cry from today's typical unit. It requires four 18-in. steam inlets with live-steam reheat between stages. Regenerative feedheating can't be used because condensate must go back to heat exchangers as cold as possible. This is to take advantage of low sodium inlet temperature and also to get lowest capital cost per kw even at a slight decrease in efficiency.

Internal, External Cooling. Two power cycles are considered for the *Case B* reactor with internal and external cooling. One cycle uses heat output of sodium over entire temperature range of 300 to 900 F. The other rejects heat of coolant below 500 F. This greatly reduces investment and gives a power output of more readily marketable size.

For both cycles, steam conditions have been taken as 400 psia and 746 F to the turbine. Absolute pressure at condenser is 1.5 in. Hg. In the first cycle, about 8.8 million lb of steam per hr is fed to turbine, with a gross thermal efficiency of about 28%. Resulting gross electrical output runs about 878 mw from five units. Auxiliary power, including sodium pumping, is about 5% of gross capability.

In the second scheme, about 4.8 million lb per hr is used, with same efficiency as in the first. Gross electrical output is about 579 mw from three units. Net output is about 554 mw. Heat from the coolant in temperature range from 300 to 500 F would be rejected by producing steam at 25 psia and condensing it at 20 psia in a water-cooled heat exchanger.

Electric Power Only. Studies assume limiting plutonium production to a 5-yr period. Power plant should be amortized in this period unless there is some way of making it useful later. After five years there would be several ways to continue power production in an era when power, rather than plutonium, would be the controlling factor.

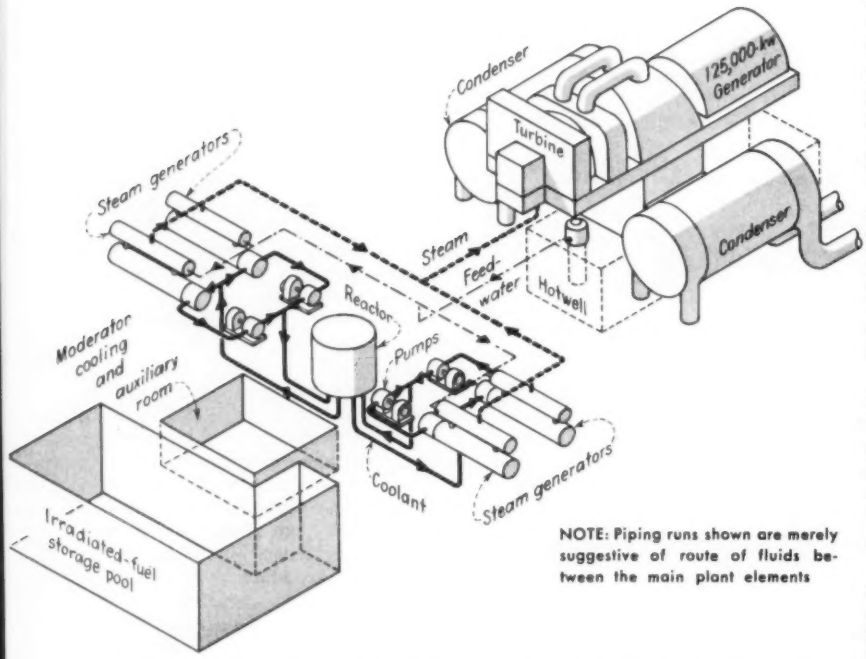
For example, the reactor could be run for power alone. But even with equipment fully amortized, cost of electricity from such a source might be just as high as from conventional fuel-burning plants. Yet such operation could be advantageous from a national point of view; the reactor, in continuous operation, would be immediately available as a military plutonium producer when needed. Value of having a standby plant in operating condition should be credited to reactor operation. This would reduce power cost.

Another course would be to shut down the reactor and replace it by a modern high-pressure boiler and high-pressure topping unit. Or, again, a high-pressure boiler alone might be built to supply the turbine. This assumes the original plant to have been designed to produce steam at some high pressure where cycle efficiency could be later improved through use of superheat.

Costs in Table II, based on preliminary information, do not include such items as land, financing charges, public liability, insurance, Federal income taxes and profit.

Pacific Gas and Electric – Bechtel

They recommend: (1) design of liquid-metal-cooled fast breeder reactor with solid fuel be undertaken now (2) construction to start when layout is completed unless advances have made the design obsolete (3) development of liquid-fuel breeder reactor



NOTE: Piping runs shown are merely suggestive of route of fluids between the main plant elements

ARRANGEMENT OF LIGHT-WATER-COOLED REACTOR, and steam generators feeding 125,000-kw capability turbine, shows relative compactness of generating station

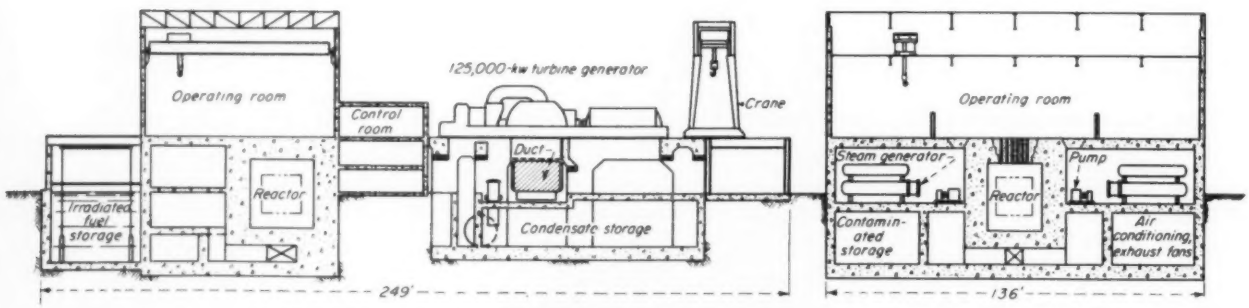
Atomic power plants are economically justified where they can operate at high capacity factor. Such operation can be integrated into the large PG&E system where one-third of the demand is base load.

Public hazard must be considered in event of a reactor failure. If a reactor should melt because of a cooling failure or a runaway, it would release radioactive and toxic gases. These should not be explosive in force. The gases would be expected to be retained primarily in the shielded area, and secondarily in the essentially air-tight building.

Present site restrictions are set by assuming all radioactive material discharges as a cloud to the atmosphere. Ten years' experience seems to show that reactors can be operated safely. These restrictions should be reviewed in trying to make reasonably remote industrial sites acceptable.

The 500-mw reactor capacity is a compromise between a smaller developmental unit and a large, more economical size. This heat release would produce significant amounts of plutonium as well as 100 to 150 mw of electrical energy. Two reactors were chosen for study.

The light-water-cooled heavy-water-moderated reactor can be designed and built quicker than others, and its cost predicted with some confidence. It is, however, limited to low steam pressures and thermal efficiency. The liquid-metal-cooled fast reactor can



LIGHT-WATER-COOLED REACTOR has thick concrete shield, steam-generator cubicles and contaminated-storage pool have lighter concrete shields to cut down dangerous radiations to the surroundings. Building, *left*, replaces usual station boiler room

I—Dual-Purpose Reactor Characteristics

Item	Water-cooled thermal reactor	Sodium-cooled fast reactor
Heat produced, mw	500	500
Gross electric power, mw	106.2	154.6
Net electric power, mw	100.6	145.3
Annual capacity factor	0.75	0.80
Annual net output, 1000 mwhr	659	1018
Materials:		
Fuel	Natural U	U-235
Fertile material	—	U-238
Core size	13.2-ft dia 11-ft high	38-in. dia 38-in. high
Moderator	D_2O	None
Reflector	H_2O	Lead
Shield	Concrete	Concrete
Primary coolant	H_2O	Sodium
Primary-coolant temp, F: In	384	600
Out	500	900
Primary-coolant press., psig	1000	—
Secondary-coolant temp, F: In	—	550
Out	—	850
Steam pressure, psig	160	485
Steam temperature, F	378	750

II—Dual-Purpose Reactor Investment

Item	Water-cooled thermal reactor	Sodium-cooled fast reactor
	(Thousands of dollars)	
Site	700	700
Site improvement, structures	2,100	2,100
Reactor structures	3,250	4,000
Reactor cores	4,150	6,000
Heavy water ($83 per lb)	7,000	—
Sodium	—	800
Cooling circuits:		
Piping and controls	2,450	3,000
Pumps and equipment	1,100	4,500
Steam generators	2,800	3,500
Auxiliary circuits	1,550	3,800
Controls	850	1,500
Fuel handling	1,200	6,000
Total reactor investment	24,350	33,100
Total turbine-generator plant	12,650	13,600
Step-up transmission facilities	1,200	1,500
Total estimated capital cost	41,000	51,000
Gross electric capacity, mw	106.2	154.6

breed new fissionable material and operate at high temperatures.

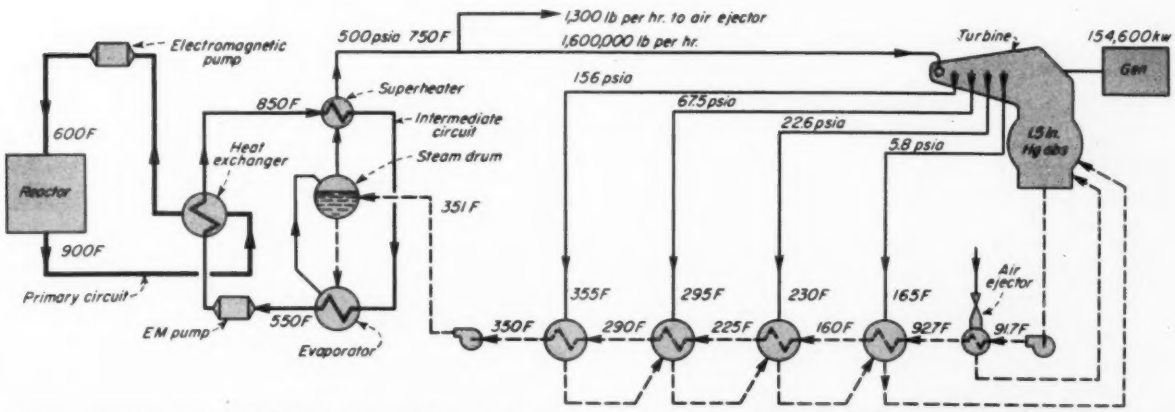
Water-Cooled Natural-Uranium Reactor. Table I gives the principal design and operating conditions for the reactor core. The reactor consists of an aluminum tank with many aluminum tubes between tube sheets containing the moderating heavy water. Pressure tubes, extending through the core tank concentric to the aluminum tubes, hold the fuel. Light water, the primary coolant, flows through the pressure tubes.

Cooling water enters the pressure tubes from an inner-ring header, below, flows through the center part of the core, through crossover pipes on top of the reactor, and down through outside pressure tubes into an outer-ring header. The reflector consists of an annulus of demineralized light water, one foot thick, surrounding the core tank, and one foot of heavy water across the top and bottom of the core tank. Several segmental tanks contain the light water. Control plates occupy the space between the tanks. This water circulates through heat exchangers in the auxiliary room within the secondary shield. Eight feet of concrete completely surround the reactor as a primary shield.

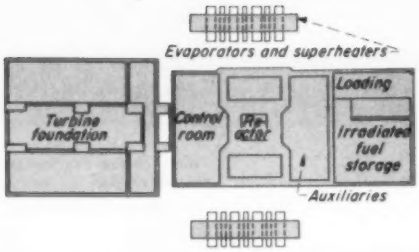
High-capacity pumps circulate the primary coolant between reactor and steam generators. These conventional centrifugal pumps and valves have injection glands to prevent leakage of radioactive water.

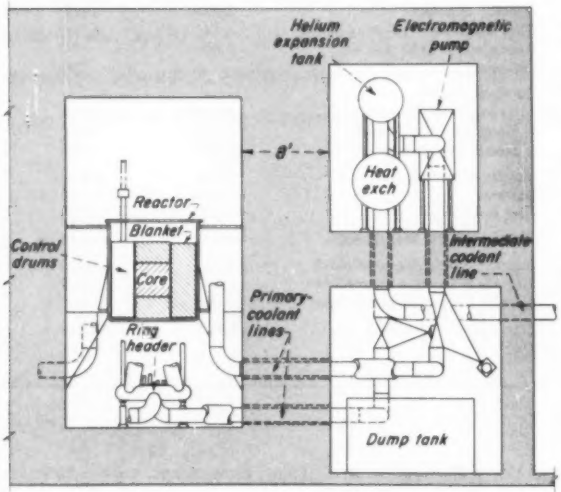
Four steam generators stand in individually shielded cubicles next to the reactor. Separate drums in each disengage entrained moisture. Heat-exchanger drums and shells are of carbon steel for 250-psig pressures. Tubes must be of stainless steel for 1100 psig and 600 F. The heavy-water-moderator cooling system handles 7.5% of the reactor total heat output.

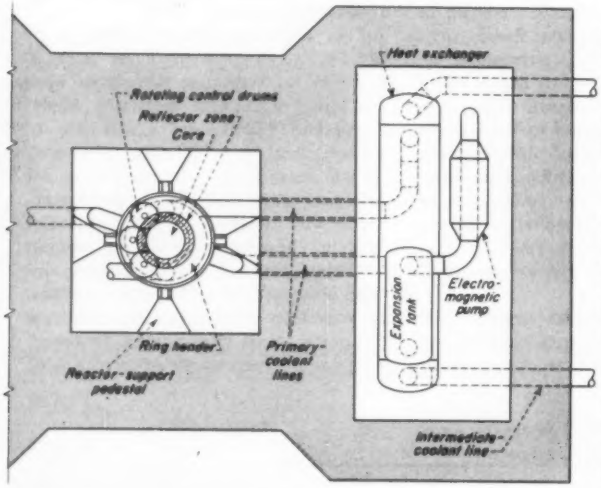
Plates, controlling the reactor, occupy aluminum sheaths between tubes. Servomotors automatically withdraw the plates from the sheaths. In emergency shutdowns an electromechanical



SODIUM-COOLED FAST REACTOR uses two sodium circuits between reactor and two steam generators. Plant net output, 145,300 kw, is produced at heat rate of 11,760 Btu per kwhr. Moderate steam conditions proved most economical for design







COMPACT SODIUM-COOLED REACTOR must be shielded and arranged for removing products and recharging at intervals

III—Power Cost, Sodium-Cooled Reactors

A: Dual-purpose reactor as currently conceived for power and plutonium
I: Dual-purpose reactor as currently conceived for power only
II: Dual-purpose reactor as currently conceived for power only after 5-year amortization
III: Future improved reactor built for power only
B: Conventional steam power plant

Item	A	I	II	III	B
			(Millions of dollars)		
Site and yard investment	2.8	2.8	2.8	1.1	0.5
Reactor-plant investment	33.1	33.1	33.1	16.6	—
Power-plant investment	15.1	15.1	15.1	12.1	13.5
Total investment	51.0	51.0	51.0	29.8	14.0
Site and yard fixed charges	0.36	0.36	—	0.15	—
Reactor-plant fixed charges	4.50	4.50	—	2.26	—
Power-plant fixed charges	2.05	2.05	—	1.65	—
Total fixed charges	6.91	6.91	—	4.06	1.90
(mills per kwhr net output)		(6.8)		(3.6)	(2.9)
Reactor annual operating cost	1.06	0.74	0.74	0.37	—
Power-plant annual oper cost	0.46	0.46	0.46	0.35	—
Total annual operating costs	1.52	1.20	1.20	0.72	0.40
(mills per kwhr net output)		(1.2)	(1.2)	(0.6)	(0.6)
Annual fuel, processing cost	10.38	4.60	2.50	1.50	1.67
(mills per kwhr net output)		(4.5)	(2.4)	(1.3)	(2.5)
Total annual costs	18.81	12.71	3.70	6.28	4.00
Net capacity, mw	145.0	145.0	145.0	160.0	100.0
Net an. output, 1000 mwhr	1020	1020	1020	1120	667
Average energy cost, mills per kwhr		(12.5)	(3.6)	(5.5)	(6.0)

device releases the plates to let them fall into their sheaths.

A storage area holds new fuel assemblies. A separate storage tank holds irradiated fuel assemblies for the necessary time. The entire reactor charge must be replaced several times per year.

Reactor-plant operation needs 103 men, and power-plant 14 men, a total of 117. These do not include maintenance men. It was assumed that fuel-element fabrication and processing would be handled by central facilities.

Liquid-Metal-Cooled Fast Reactor. Table I gives details of the reactor, shown on page 100. A breeder blanket of depleted or natural uranium surrounds the reactor core of highly enriched material. An assembly of a large number of stainless-steel fuel elements make up the core. A reflector will probably envelop the core, decreasing the critical mass and limiting the heating outside the core. All these are in a cylindrical steel vessel, 8x8 ft. The vessel must be designed to circulate the liquid sodium, to refuel, and to accommodate control mechanisms.

Two electromagnetic pumps circulate the primary coolant to two intermediate heat exchangers at 900 F, returning to the reactor at 600 F, p. 99. The intermediate coolant (sodium) heats the two steam generators. The intermediate heat exchanger can be a single-tube design since sodium leakage from intermediate to primary circuits will not affect reactor operation.

Moving a reflector between core and blanket, or altering disposition of fertile and fissionable material can be used to control the reactor. Either method can use control drums, p. 100. Another possibility is a movable reflector outside the core, which can be raised or lowered to change reactivity.

Need for an inert atmosphere (helium), above the sodium at all times, complicates refueling. Complete refueling of the core and inner portion of the breeder blanket will be needed once a year. If the reactor runs as a converter, the U235 remaining in the core must be decontaminated and reprocessed. If the reactor runs as a breeder, a portion of the separated and decontaminated plutonium must be reprocessed to make up a future core.

The reactor is designed to run with an 80% annual capacity factor. One month is provided for scheduled maintenance and refueling.

The fast reactor cannot be considered equal to the water-cooled reactor on the basis of existing technology, time needed for design and construction, reliability of cost and performance estimates, or safeguards and degree of isolation now required.

Two more years will be needed to complete a fast reactor

installation, compared to a water-cooled thermal reactor. This could be reduced at the expense of additional and parallel development work.

Test results to date have not shown any limitations on temperature of liquid sodium. With further experience it may be possible to raise coolant temperatures to generate 1000-F steam for the turbine.

Economic Studies. Table II gives the estimated investment costs for the two types of dual-purpose reactors. All costs are based on June 1952 rates and prices. They are contractor's price, plus 10% for owner's overhead. AEC laboratory nuclear design and development entails considerable cost that was not included in these estimates. This was not considered chargeable to a specific project.

Table III shows the results of brief studies made to measure the economic feasibility of nuclear energy. These are based on 20-year amortization for power and fuel fabrication plants, private utility financing, 80% capacity factor.

Case I shows that an immediately feasible nuclear-power plant cannot compete with current steam-electric plants. The 3.6 mills per kwhr of Case II assumes capital costs of the plant have been amortized, and shows the plant would have substantial value as a power producer after retirement from plutonium production. Case III indicates that a future atomic plant might produce power on a competitive basis. This assumes reduced costs stemming from: improved technology, operating experience, construction of a large block of capacity (500 mw) at one site.

Certain improvements in thermal efficiency could be attained by refinements of design in the turbine-generator plant, resulting in plutonium-cost reductions. This becomes increasingly important as the economic life of the project is extended. Uncertainties with the initial plant, however, and the desire to minimize investment make it preferable not to use such refinements now.

When reactor operating conditions have been established in an actual design, detailed analysis should be made to evaluate cycle refinements. On a project for power only these would be of greater importance.

Conclusions. 1. Dual-purpose reactors are now technically feasible.

2. Construction and operating costs of the water-cooled thermal-type reactor can be predicted with fair degree of accuracy. Detailed design of such a reactor can be started promptly. Placing primary emphasis on plutonium production, at earliest possible date for a definite production period, will make this reactor very attractive.

3. The liquid-metal-cooled fast reactor conserves uranium and promises to be adaptable to high steam conditions. This makes it more attractive for power. Design and construction ought to be undertaken even though certain development work will be needed during the design period.

4. Though the liquid-fuel fast reactor seems to have greatest possibility of low-cost power production, the development still needed prevents design and construction in the near future.

5. It seems power sales from a dual-purpose reactor will not reduce the cost of plutonium production by a substantial amount. Under present plutonium demand and cost conditions, however, power sales more than justify the additional equipment in dual-purpose plants. After plutonium demand ceases and investment is recovered, the reactors may be economically valuable as power producers only.

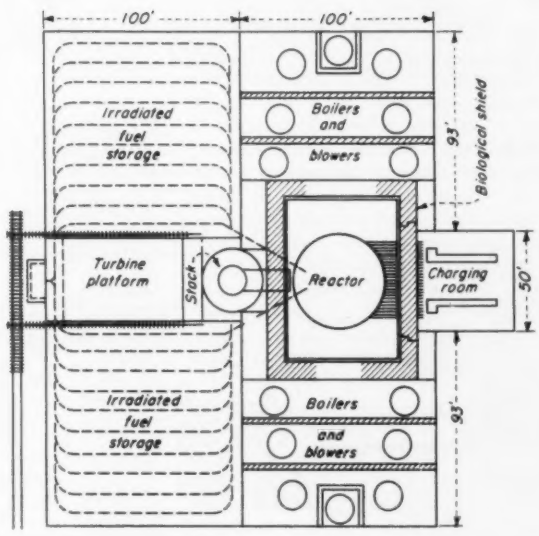
Commonwealth Edison – Public Service

This group believes heavy-water-moderated and cooled reactor has best economic possibilities. But they see the gas-cooled reactor as a substantial beginning in atomic power, one causing minimum interference with production reactors now under construction or contemplated

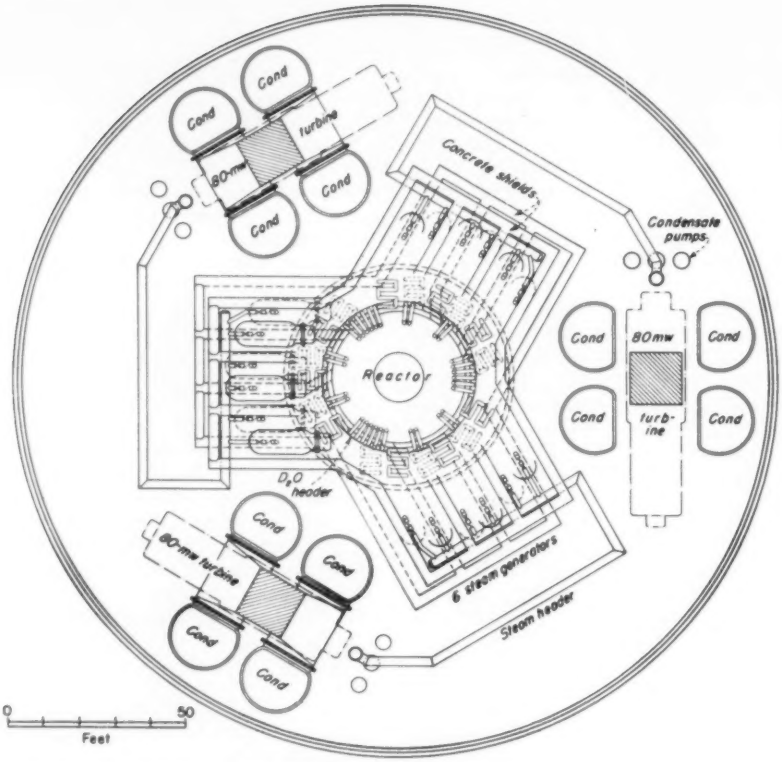
Two reactors were considered: (1) gas-cooled graphite-moderated (2) heavy-water-moderated and -cooled. The gas-cooled unit was chosen first, because more information was available on engineering, construction and operating experience. It seemed that less extrapolation of design data, less time and expense for research and development would be needed.

The heavy-water reactor was conceived essentially by the Argonne National Laboratory. The working group primarily helped in solving some of the electrical, mechanical and structural design problems, and prepared cost estimates.

Gas-Cooled Reactor. This 350-mw heat-output unit has

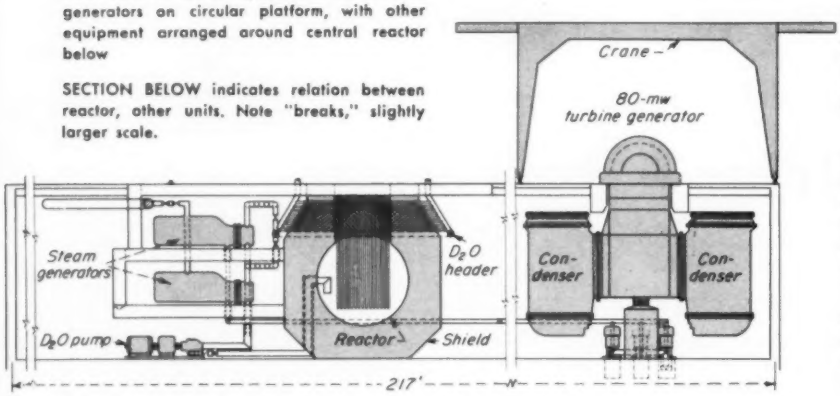


HELIUM-COOLED REACTOR: boilers in 60-ft-high building feed 250-psig 525-F steam to 60-mw turbine on open platform

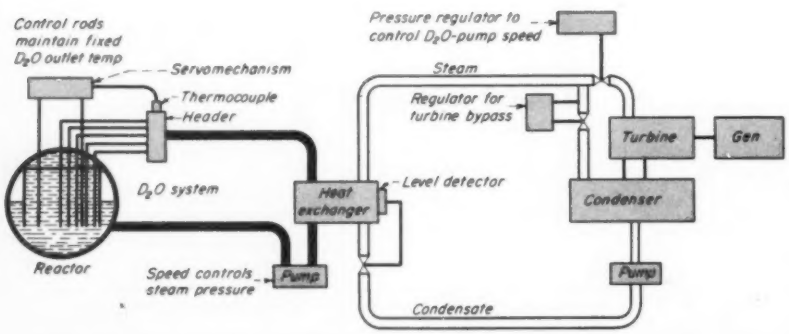


PLAN ABOVE shows layout of three turbine-generators on circular platform, with other equipment arranged around central reactor below

SECTION BELOW indicates relation between reactor, other units. Note "breaks," slightly larger scale.



HEAVY-WATER-COOLED REACTOR feeds 18 steam generators, which supply three 80-mw turbines with 180-psia saturated steam. Design minimizes heavy-water needs



FLOW CIRCUITS OF LIQUID-COOLED REACTOR need controls for safe operation. Bypass around turbine leads steam to condenser on a sudden load drop and on low loads

two right-circular graphite cylinders with adjoining end faces parallel to each other on the same center line. These cylinders contain natural-uranium slugs arranged in a lattice. The slug channels parallel the cylinder axes. The cooling gas (helium) enters the small gap between the two cylinders and divides its flow outward through the two reactor sections. A pressurized steel shell encases this assembly.

The two core sections, each 35 ft dia and 10 ft thick, contain about 985 tons of high-purity high-density graphite. About 500 tons of lower grade carbon surrounds the core sections and acts as a reflector.

Uranium-metal fuel slugs have a center hole and fins resting on the slug-channel surfaces. It was assumed heat generates uniformly within the metal, and flows uniformly from all parts of the surfaces. Maximum metal temperature is limited to 1000 F to prevent phase transformation at 1200 F. More reactor power could be realized by developing an alloy and casing that could withstand internal temperature of about 1300 F.

Coolant. Helium was selected because it has no chemical-combination properties with uranium and has a zero neutron-absorption cross section. Pressurizing the helium to 10 atmospheres reduces the power needed to transfer a fixed quantity of heat.

Reactor Shell. Openings in the 44-ft-dia sphere allow feeding uranium slugs into the graphite core. Tubes connect the end of each fuel channel in the graphite to fittings in the sphere wall. Special closures prevent helium loss at 10 atmospheres and 750 F.

Other openings allow circulating helium through the shell, inserting control rods and instruments, removing irradiated uranium slugs.

Shielding and Ventilation. A concrete radiation shield (having the shape of a modified Quonset hut) completely encloses the reactor sphere. Ten feet from the sphere charging face a vertical 8-ft-thick concrete wall, supported on rollers, moves with expansion of the charging tubes piercing it and the sphere. Six feet from the other side of the sphere stands the opposite 8-ft-thick concrete wall.

Hot air inside the shield rises through a direct-connected stack. This maintains a negative pressure inside the shield, causing all air to leak into the shield. This air becomes radioactive and must be diluted before being discharged to atmosphere.

Charging and Discharging. Two channels at a time may be charged by a 6-cylinder charging machine in a sequence operation. The cylinders move

their charge into the sphere channels by helium pressure. The irradiated slugs drop out of the core on the far side and accumulate at the bottom of the sphere. They are removed through pressure locks into the storage canal located below the sphere.

Reactor Control. The more important reactor instruments measure power level, reactor period, temperature and pressure of helium. Manual and semiautomatic movement of control rods regulates the reactor. Automatic positioning maintains constant helium temperature at the boiler inlet. Remote indicators on the control board show their position. The rods are moved with enough energy storage to operate them several times, over their full travel after an auxiliary power failure.

Eight vertically mounted boron-steel safety rods drop into holes in the reactor graphite when released by normally energized clutches. They quickly stop reactor operation when (1) neutron density exceeds safe value (2) reactor gas-outlet temperature exceeds safe level (3) reactor gas pressure drops suddenly (4) auxiliary power fails (5) reactor period becomes shorter than minimum value (6) helium-coolant flow stops (7) automatic trip button is pressed.

Helium Cycle. Helium leaves the reactor sphere at 650 F to enter the boilers. Leaving boilers at 384 F it enters gas blowers to be returned to the reactor. Multiple take-offs and the need for reasonable duct sizes require 12 separate circuits for the helium.

Boilers are straight-through types in which economizer, evaporating and superheating sections are combined into one continuous pass. A 3½-in. feedwater line enters the shell through a thermal sleeve and connects to a 6-in. inlet header. From this header 48 one-in.-OD tubes spaced on 2-in. horizontal centers form a bundle of 48 hairpin loops spaced on 2-in. vertical centers. These tubes terminate in an 8-in. steam header. There are 95 loops in each of the circuits. The shell is about 13 ft dia and 23 ft, 6 in. long, with 6-ft-dia flanged openings at both ends to which the helium ducts connect.

There are 12 boilers, although 10 can develop full reactor power. Each boiler can produce 90,600 lb per hr of 250-psig 525-F steam from 109-F feedwater. This assumes 2.5-in.-Hg backpressure on main turbine.

Blowers. The axial-flow-type helium blowers must run at constant flow. Flow variations must equal capacity of one blower. Load variations with a fixed number of blowers running are made by varying helium temperature out of the boilers. Twelve blowers, 75,000 cfm each, supply total helium flow. Half the blowers are steam-turbine driven, others are electrically driven. Over-all dimensions of blower and drive are about 20 ft long, 9 ft wide, 9 ft high.

While helium does not become radioactive, it might carry particles of active materials. Removable concrete blocks, 2 ft thick, used for shielding permit maintaining boilers and blowers. No radioactivity transfers from helium to steam in the boilers.

Underground storage tanks, occupying 45 acres, store the helium. Miscellaneous buildings with total area of 15,000 sq ft house the valves, controls and purifying equipment.

Turbine-Generator. The 650-F helium temperature led to selecting 525 F for steam leaving the boilers. The 265-psia pressure kept exhaust moisture below 14.7%. At 2.5-in.-Hg backpressure the turbine generates 61,700 kw gross at 14,500-Btu-per-kwhr heat rate. Electric auxiliaries use 15,000 kw, leaving a net of 46,700 kw. Steam auxiliaries use an equivalent 12,000 kw.

Plant Control. Automatic control-rod adjustments hold reactor helium-outlet temperature to 750 F. Adjusting feedwater flow varies the boiler rating, and the boiler-outlet helium temperatures. Boiler output determines kw generation. Steam temperature varies from 525 F at full load to a theoretical 650 F at zero load. A steam-pressure controller regulates the turbine governing valves.

To achieve high plutonium production the reactor should be held at full power rating even while electric generation is reduced. A steam bypass line around the turbine to the condenser dissipates the heat in excess of that needed by the turbine. The bypass automatically protects the reactor in event of a turbine tripout.

Costs in Table I are based on conditions in the Middle West. They do not include costs of fuel fabrication and processing. Assuming a net output of 45,000 kw, the installed cost averages $889 per kw.

Liquid-Cooled Reactor. This cylindrical unit, enclosed in a spherical steel shell at 800-psia pressure, uses heavy water as coolant, moderator and reflector. Fuel assembly is made up of separate elements, each consisting of a group of uranium slugs in a thin metal casing. These are placed in vertical, cylindrical channels. Heat from the uranium passes through the thin metal cladding to heavy water, passing in a vertical direction upward. Heavy water flows between and through the fuel channels. The flow between channels acts as the moderator; traveling relatively slowly, it discharges through the control-rod assemblies. The fuel elements hanging vertically in the channels are charged and discharged through the cylinder top. Fuel-element maximum surface temperature is 465 F when reactor-outlet heavy-water temperature is 440 F.

An economic analysis showed 440-F heavy water out of reactor and 180-psia steam pressure to be best. This develops 1064 mw of heat in the reactor. The heavy-water system must run at 800 psia. A 25-psi pressure drop in the reactor develops 25-ft-per-sec water velocity.

A helium-blanketing system protects heavy-water surfaces in the re-

I—Estimated Costs, Gas-Cooled Reactor

Reactor structure	$ 1,940,000
Fuel loading, tubes	2,000,000
Instrumentation and controls	1,200,000
Raw graphite, 2400 tons	1,000,000
Finished graphite, 2100 tons, machined and installed	1,260,000
Elevators, charging equipment	300,000
Total reactor assembly	$ 7,700,000
Boilers, 12, accessories	4,025,000
Turbine-generator, 60 mw, accessories	4,305,000
Stack, 500-ft high	500,000
Water system, decontamination area, waste storage	100,000
Buildings	4,200,000
Helium system	1,650,000
Electric facilities	1,725,000
Miscellaneous, site, land, etc	4,325,000
Contingencies	4,420,000
Engineering, 5%	1,700,000
Overhead, 15%	5,350,000
Grand total	$40,000,000

II—Estimated Costs, Heavy-Water Reactor

Reactor	$ 3,846,000
Heavy-water system	3,172,000
Heavy water ($82 per lb)	41,000,000
Helium system	230,000
Total reactor assembly	$48,248,000
Steam-generator plant	4,178,000
Turbine-generator plant (240 mw)	14,285,000
Structural plant	10,024,000
Miscellaneous power equipment	342,000
Electric facilities	5,513,000
Site, other land costs	1,625,000
Miscellaneous, yard improvements, temporary construction	2,740,000
Research and development	2,500,000
Contingencies	8,700,000
Engineering	4,500,000
Overhead, 15%	15,345,000
Grand total	$118,000,000

actor sphere outside the cylinder, and in the dump and makeup tanks.

Shielding. Reinforced limestone-aggregate concrete, 8 ft thick, shields the reactor, see sketch p 102. Steel plates line the inner and outer surfaces of the shield. The vertical fuel-element-charging and control-rod tubes and the horizontal water-discharge pipes leading from these tubes to the headers form a large part of the top shield.

Shielding around steam generators, piping, pumps and miscellaneous storage tanks consists of 3-ft-thick concrete floors, walls and ceilings. Steam generators and pumps stand in individual cells reached through plug-type trap doors. Turbines, turbine piping and auxiliaries stand in open, unshielded areas accessible for normal maintenance.

To make repairs on a unit of equipment, motor-operated shutoff valves first isolate it from the heavy-water system. The activated heavy water in the unit then drains to a shielded storage tank. Light water flushes out the unit until radioactivity falls to a level safe for men to enter the cell and perform the necessary repair work.

Reactor Control. Amount of heavy water flowing from the reactor and its temperature at each fuel-tube outlet and control-rod opening are monitored. Manually operated valves on each tube adjust flow distribution over the reactor lattice area. Adjustments are made on the basis of two thermocouple readings at each tube outlet. A rapid-scanning device for pressures and temperatures helps localize defects as they develop. The scanning equipment automatically shuts down the reactor when certain limits are exceeded. Failure of both thermocouples on any tube shuts down the reactor. Defective flow detectors are considered a serious hazard.

Several thermocouples in the hottest area of the reactor measure and record the uranium-metal temperature.

Safety rods dropping into place automatically shut down the reactor on: (1) loss of sphere pressure (2) excessive reactor power (3) short reactor period (4) fuel-element failure (5) serious heavy-water leak (6) steam-generator failure (7) excessive radioactivity in reactor building.

Control rods of 1.5%-boron steel are clad with stainless steel to resist corrosion. Guide tubes prevent the rods jamming in the tube sheets or shifting their position by flow of the coolant. Coolant flow dissipates heat generated in the rods.

Piping. To minimize the amount of coolant holdup in the piping, a flow velocity of 25 ft per sec was chosen, and the length of piping was held to a minimum by arranging the steam generators in a tight circle around the reactor as shown at top of p 102.

Angle headers, taking the heavy water from the 211 individual fuel elements and control-rod headers, connect to a ring header 21 ft in radius circumscribing the reactor. This header feeds the 18 individual 12-in. headers connected to the top of the steam-generator coolant boxes. The 12-in. outlet connections, from a pair of steam generators, join an 18-in. suction line to one of the nine coolant-circulating pumps. The pumps' discharge headers, 18 in. dia, connect to the reactor at equally spaced intervals around the reactor shell.

Steam Generators. Each of the 18 units produce 180,000 lb per hr of 180-psig saturated steam. These are arranged in pairs to reduce the number of coolant pumps and valves. Each unit has an 88-in.-dia shell, 24 ft long. The 656 U-tubes have a total heat-transfer surface of 3975 sq ft. The coolant enters and leaves at the same end from a single box with a horizontal division wall to separate inlet and outlet compartments.

By using a double tube sheet, one serves as an end plate for the steam and water shell and the other as the plate of the coolant box. This avoids leakage of the coolant into the light-water system and simplifies detection of tube-roll leakage. A subcooling section uses incoming feedwater to subcool the leaving coolant.

Coolant-circulating pumps presented one of the major design problems of the plant. This arose from the combination of the large flows to be handled, the high suction pressure to be sealed, the essentially low gland leakage, the high liquid temperature and the coolant radioactivity. The pumps are single-stage overhanging-impeller design with the one gland exposed to suction pressure. To avoid flashing in the gland, coolant at 100 F enters an intermediate point of the gland. The seal coolant flows along the shaft through labryrinthine packing into the pump in one direction and into an annulus in the opposite direction. About 5 to 10 gpm of seal coolant is needed. The small external leakage drains back to the makeup tank. Gland-seal coolant comes from each pump discharge, passing through a small heat exchanger before entering the gland.

One of the three pumps for each main unit is steam-turbine-driven, the other two are driven by 2000-hp electric motors through hydraulic couplings. The couplings assist in controlling plant output on load variation.

Turbine-Generators. Three 80,000-kw units supplied by the reactor can generate a total of 254,000 kw with 1-in.-Hg abs backpressure, at a heat rate of 14,111 Btu per kwhr. Net steam available for main turbines will generate 246,100 kw. Electrical auxiliaries will use 14,000 kw, leaving a net output of 232,100 kw. At 2.5-in.-Hg backpressure the net drops to 211,500 kw.

The tandem-compound double-flow turbines have 35-in. last-stage buckets. Since the turbines use saturated steam they have two moisture-extraction locations. One uses notches in the leading edge of the buckets to throw the moisture to an annulus in the casing, where it is carried out of the turbine by 1% extraction of steam. This reduces moisture from 7.4 to 6%.

The other consists of a series of corrugated plates in the large crossover. The plates separate the moisture and carry it to a drain, reducing steam moisture content from 10.6 to 6.6%.

Because of the low steam pressure and the nonextraction cycle used, the surface condensers become very large. To attain 1-in.-Hg backpressure there must be 130,000 sq ft of surface. Four 35,000-sq-ft units per turbine seem to be the best arrangement. Makeup water for the plant comes from a demineralizer since bled or exhaust steam is not available for evaporators.

Costs. Table II shows the estimated investment for the 240,000-kw installed-capacity plant. The total of $118,000,000 represents $492 per kw. If the reactor was designed for light-water cooling and moderation, which would require enriched fuel, the initial investment could be reduced by about $47,000,000. Cost per kw would drop from $492 to $297. These cost figures assume that fabricated fuel elements are furnished by others. Cost of the initial fuel charge has not been included.

Conclusions. Considering present status of reactor technology, it is felt that the heavy-water-reactor concept has the best economic possibilities. Uncertainties are availability and cost of heavy water, practicality and cost of chemical plants to process the fuel elements.

The gas-cooled reactor could provide a substantial beginning in atomic power with minimum interference with production reactors now under construction or contemplated. Fuel elements should be less costly than some of those used in production reactors, they can be processed in existing plants. Both reactor designs are feasible from engineering and operating standpoints.

Power's DATA SHEET

No. 253

Typical Cable Applications in Generating Stations

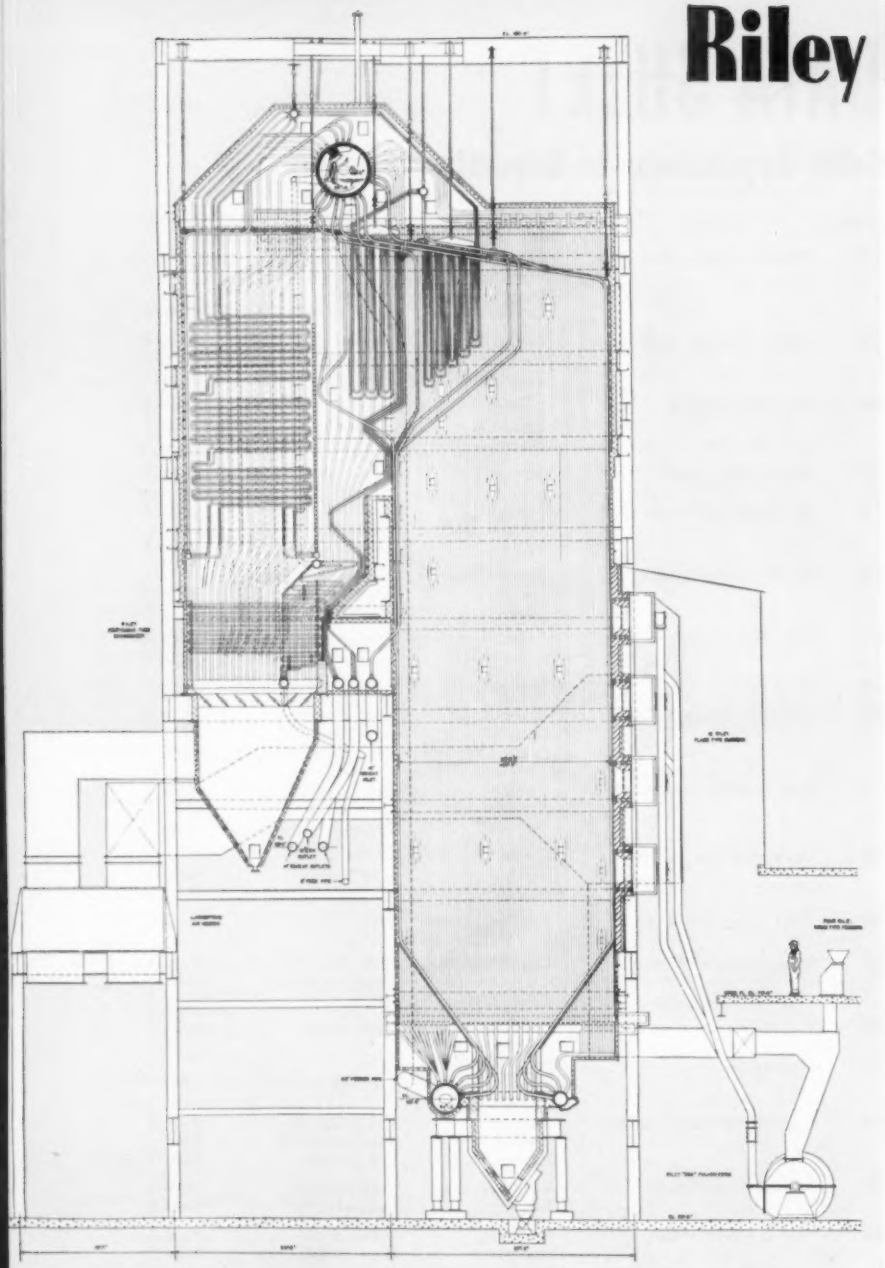
Service	Max 3-ph voltage	Insulation	Installation	Covering	Finish
GENERATOR LEADS, BUS TIES, ETC[1]	2,000	Heat-resistant rubber (RH)	Conduit[2]	Cotton braid	Note 3
			Insulators	Cotton braid	Note 3
			Ducts[4]	Neoprene jacket	None
			Conduit, ducts	Lead sheath	Note 5
	15,000	Ozone-resistant rubber[6]	Conduit[2]	Cotton braid	Note 3
			Ducts[5]	Neoprene jacket	None
			Conduit, ducts	Lead sheath	Note 5
	17,000	Varnished-cambric	Conduit[2]	Cotton braid[7]	Note 8
			Insulators	Cotton braid	Note 8
			Ducts[4]	Lead sheath[7]	Note 5
	17,000	Impregnated paper	Any	Lead sheath	Note 5
AUXILIARY MOTORS	2,000	Heat-resistant rubber (RH)	Conduit[2]	Cotton braid[9]	Note 3
			Conduit, ducts	Neoprene jacket	None
			Ducts[4]	Lead sheath[10]	Note 5
	15,000	Ozone-resistant rubber[6]	Conduit, ducts	Neoprene jacket	None
			Conduit[2]	Cotton braid[9]	Note 3
			Ducts[4]	Lead sheath[7, 10]	Note 5
	17,000	Varnished-cambric	Conduit[2]	Cotton braid	Note 8
			Ducts[4]	Lead sheath	Note 5
	600	Vinyl resin	Conduit	None	None
	5,000	Asbestos-varnished-cambric	Conduit[2]	Cotton braid[9]	Note 8
			Conduit[2]	Asbestos braid[9]	HF[11, 12]
			Ducts[4]	Lead sheath[10]	Note 5
CONTROL CABLES	600	Heat-resistant rubber	Conduit[2]	Cotton braid	Note 3
			Conduit, ducts[4]	Lead sheath[12]	Note 5
			Ducts[4]	Neoprene jacket	None
	600	Ozone-resistant rubber	Conduit[2]	Cotton braid	Note 3
			Conduit, ducts[4]	Lead sheath[12]	Note 5
			Ducts[4]	Neoprene jacket	None
	600	Vinyl resin, polyethylene	Conduit, ducts	Vinyl resin	None
EXCITER AND FIELD LEADS[1]	15,000	Ozone-resistant rubber	Conduit, ducts	Lead sheath[12]	Note 5
			Conduit, ducts	Neoprene jacket	None
			Conduit, ducts	Cotton braid	Note 3
	17,000	Varnished-cambric	Conduit, ducts	Lead sheath[12]	Note 5
RHEOSTATS	300	All asbestos	Faceplate to resistors	Asbestos braid	HF[11]
BOILER ROOMS, ASHPITS	5,000	Asbestos-varnished-cambric	Conduit[2]	Cotton braid[9]	Note 8
			Conduit	Asbestos braid[9]	HF[11]
			Ducts[4]	Lead sheath	Note 5
	5,000	Varnished-cambric	Conduit[2]	Cotton braid[9]	Note 8
			Ducts[4]	Lead sheath	Note 5
	2,000	Heat-resistant rubber (RH)	Conduit[2]	Cotton braid[9]	Note 8
			Ducts[4]	Lead sheath	Note 5
			Conduit, ducts	Neoprene jacket	None
POWER TRANSFORMERS Primary and secondary services	2,000	Heat-resistant rubber (RH)	Conduit	Asbestos braid	Paint-filled
			Ducts[4]	Lead sheath	Note 5
			Conduit, ducts	Neoprene jacket	None
	8,000	Ozone-resistant rubber[6]	Conduit	Asbestos braid	Paint-filled
			Ducts[4]	Lead sheath	Note 5
			Conduit, ducts	Neoprene jacket	None
	17,000	Varnished cambric	Conduit	Cotton braid	Note 8
			Ducts[4]	Lead sheath	Note 5
	132,000	Impregnated paper	Conduit, ducts	Lead sheath	Note 5

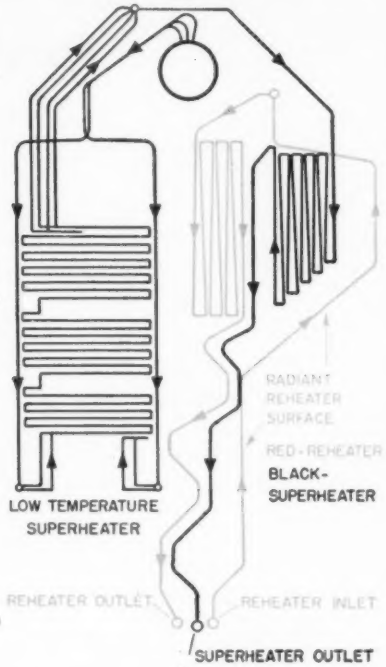
Notes: 1—usually overinsulated. 2—essentially dry; if moist consider ducts. 3—smooth black. 4—moist locations. 5—Neoprene hose-type jacket overall for protection against corrosion and electrolysis. 6—preferably shielded above 2 kv. 7—look up shielding recommendations. 8—smooth black or slow-burning paint-filled and finished for indoor work. 9—Interlocked steel armor overall for metallic pan construction; alternate of bronze for single conductor or for corrosive conditions. 10—alternate of lead sheath, fibrous covering and interlocked armor for pan construction. 11—heat-, flame- and moisture-resistant. 12—in hotter locations. 13—for more reliability.

Courtesy F Aime, Electrical Engineer, Anaconda Wire & Cable Co

© POWER

Riley Reheat Unit





SUPERHEATER AND REHEATER CIRCUITS

Engineering Data

Capacity, 575,000 lbs./hr.
Design Pressure, 1,700 psig.
Steam Temperature, 1,000°F.
Reheat Temperature, 1,000°F.
Furnace Volume, 53,000 cu. ft.
Temp. Furnace Exit Gas, 1,900°F.
Furnace Width, 29'3"
Furnace Depth, 23'10⅞"
Efficiency, 87.8%
Fired by 4 Riley "50" Pulverizers and 12 Riley Flare Type Burners

UTAH POWER & LIGHT CO., SALT LAKE CITY, UTAH
575,000 lbs./hr. — 1700 psig, 1000°F. — 525,000 lbs./hr. reheat — 396 psig, 1000°F.
Bechtel Corp., Engineers.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Charlotte Atlanta New Orleans St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS

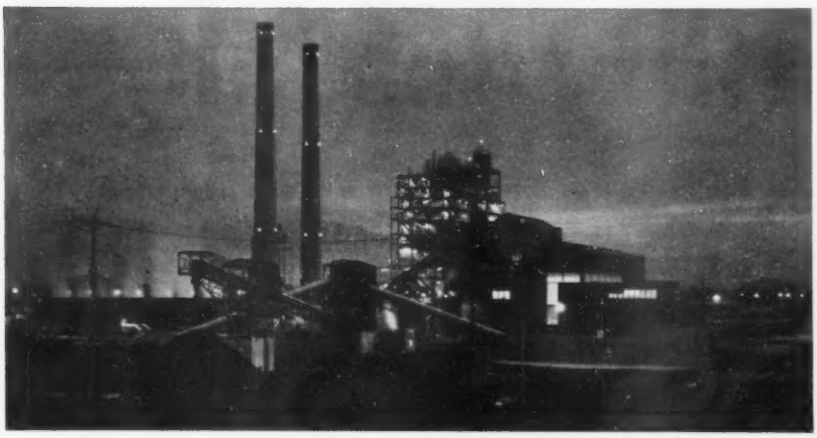
at Utah Power Giving Outstanding Results

The Riley Reheat Unit at Gadsby Station of Utah Power and Light Company went on the line in November and has been giving entirely satisfactory performance since that time.

Operation has proven the advantages and desirability of the radiant section of the reheater, which permits operation at sufficiently low furnace exit temperatures to prevent objectionable furnace slagging and provides a relatively flat reheat temperature curve. No difficulty was experienced with rapid start-up because of this design feature.

The Riley unit is operating with air heater exit gas temperatures approximately 40 degrees lower than guarantees, resulting in appreciably higher than guaranteed efficiencies. Draft losses are also materially lower than guaranteed, providing an additional operating saving.

Here is another case where Riley provided many plus values and gave the purchaser more than his money's worth. Proof that it is profitable to rely on Riley. It will possibly pay you to investigate Riley equipment when considering steam generating or fuel burning equipment.



Twilight view of Riley Units 1 and 2, Utah Power & Light Co., Gadsby Station

A Few Riley Public Utility Sales

TEXAS ELECTRIC SERVICE COMPANY
1,250,000 lbs./hr., 2125 psig, 1000°F. and 1000°F. Reheat—Pressurized Furnace
Ebasco Services, Inc., Engineers

DALLAS POWER & LIGHT CO.
1,250,000 lbs./hr., 2125 psig, 1000°F. and 1000°F. Reheat—Pressurized Furnace
Ebasco Services, Inc., Engineers

HOUSTON LIGHTING & POWER CO.
1,250,000 lbs./hr., 2125 psig, 1000°F. and 1000°F. Reheat—Pressurized Furnace
Ebasco Services, Inc., Engineers

DEPARTMENT OF WATER & POWER
CITY OF LOS ANGELES, CALIFORNIA
1,200,000 lbs./hr., 2075 psig, 1000°F. and 1000° Reheat

LOUISIANA POWER & LIGHT CO.
1,000,000 lbs./hr., 1725 psig, 1005°F. and 1005°F. Reheat—Pressurized Furnace
Ebasco Services, Inc., Engineers

MONONGAHELA POWER COMPANY
700,000 lbs./hr., 1050 psig, 905°F.
Sanderson & Porter, Engineers

SOUTHWESTERN GAS & ELECTRIC CO.
630,000 lbs./hr., 1050 psig, 1005°F.
Pressurized Furnace
Sargent & Lundy, Engineers

CENTRAL ILLINOIS LIGHT CO.
600,000 lbs./hr., 950 psig, 900°F.
Commonwealth Services, Engineers

NORTHERN STATES POWER CO.
385,000 lbs./hr., 1500 psig, 950°F.
Pioneer Service & Engineering Co., Engineers

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
460,000 lbs./hr., 1025 psig, 900°F.
Ford, Bacon & Davis, Engineers

THE POTOMAC EDISON CO.
700,000 lbs./hr., 1050 psig, 905°F.
Sanderson & Porter, Engineers

IOWA ELECTRIC LIGHT & POWER CO.
300,000 lbs./hr., 975 psig, 910°F.

SOUTH CAROLINA GAS & ELECTRIC CO.
400,000 lbs./hr., 1475 psig, 955°F.
Gilbert Associates, Engineers

UTAH POWER & LIGHT CO.
620,000 lbs./hr., 1500 psig, 955°F.
Bechtel Corp., Engineers

PUBLIC SERVICE CO. OF INDIANA
400,000 lbs./hr., 1000 psig, 910°F.
Sargent & Lundy, Engineers

ARKANSAS POWER & LIGHT CO.
650,000 lbs./hr., 1050 psig, 905°F.
Ebasco Services, Inc., Engineers

GULF POWER COMPANY
325,000 lbs./hr., 1000 psig, 900°F.
Southern Services, Engineers

IOWA-ILLINOIS GAS & ELECTRIC CO.
250,000 lbs./hr., 975 psig, 905°F.

OHIO EDISON CO.
225,000 lbs./hr., 975 psig, 900°F.
Commonwealth Services, Engineers

SOUTHWESTERN PUBLIC SERVICE CO.
330,000 lbs./hr., 1050 psig, 900°F.

MISSISSIPPI POWER CO.
230,000 lbs./hr., 925 psig, 850°F.
Southern Services, Engineers

INTERSTATE POWER CO.
200,000 lbs./hr., 725 psig, 910°F
Sargent & Lundy, Engineers

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power cost.

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

It's JOY for OIL-FREE AIR

Above: Joy WNO-112 Oil-Free Compressor

Below: Joy WGO-9 Oil-Free Vertical Compressor

Backed by manufacturing experience since 1915

★ Special lightweight pistons minimize wearing pressure on the rings.

★ Ease of disassembly facilitates inspection of pistons, rings, cylinder liners and valves.

★ On-the-job-replaceable chrome-plated cylinder liners for hard, smooth, friction-reducing surfaces. Also replaceable crosshead guides.

★ Carbon graphite compression rings designed to compensate automatically for wear.

★ Large, direct air passages and liberal water-jacketing reduce heat of compression and increase ring life.

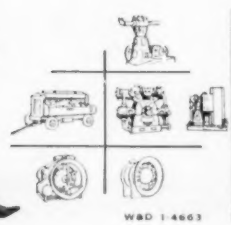
★ Patented Dual-Cushion valves, all parts of which are made from corrosion-resistant materials.

★ All wearing areas, except carbon rings, are either chrome-plated, surface hardened, or of stainless steel.

★ Complete line of types and sizes of compressors to meet *any* capacity and pressure requirements. ● Let us quote on your air supply needs of any nature. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Consult a Joy Engineer

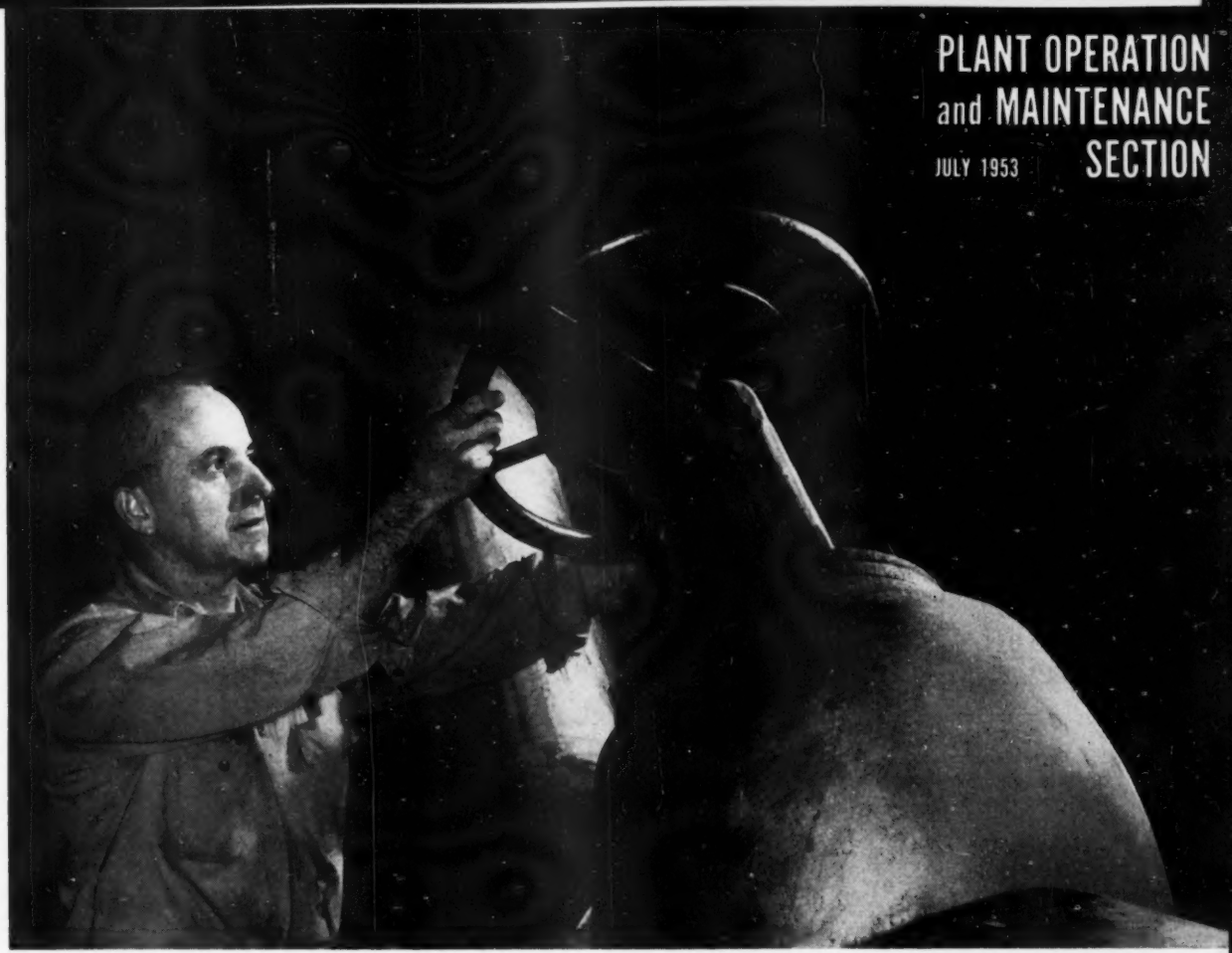
for Vaneaxial Fans . . . Compressors, Vacuum Pumps and Boosters . . . Oxygen Generators



WAD 1-4663

JOY

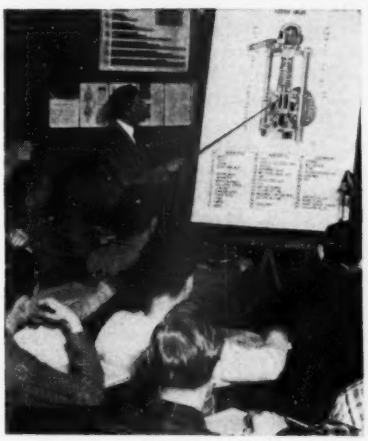
SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885

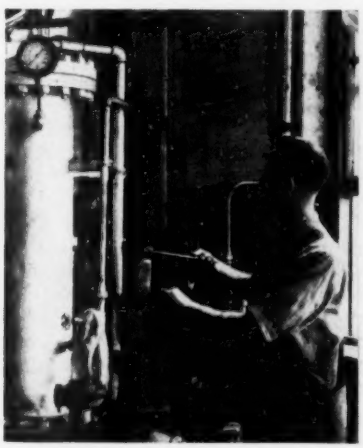


NONRETURN valve on boiler is opened by maintenance man at Eastman Kodak Co's Hawkeye plant. Experience shows that it pays to instruct all personnel in the operation and maintenance of valves because their upkeep can run into big money

'KNOW COMMON VALVES,'

says F J Ardolino, assistant supt of sewage plant. Here are valve instructions he gives to his men so they can pass test for job-promotion requirement



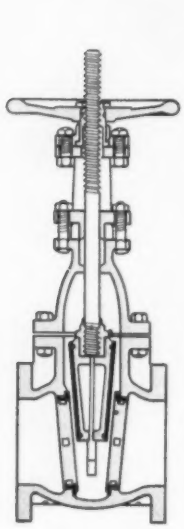


CLASS of power-plant youngsters at Dow Chemical Co soak up valve info to help pass upgrading exams. Testing relief valve *(right)* assures operation when installed

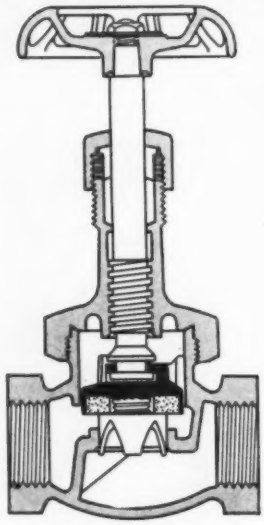
► METALS for valves are usually brass, bronze, iron or steel. When selecting valves for steam, cold water, oil or gas, almost any of these metals is good enough. But each has certain limits. Never use brass above 550 F. Bronze can stand 350-psi pressure and temperature up to 700 F. Bronze and brass valves usually come in smaller sizes, up to and including 3 in. Above this size, use iron up to 250 psi and 500 F. Steel is for temperatures above 550 F, and is also used when valve must withstand high internal or external pressures or shock.

Markings. Look at the valve body. A

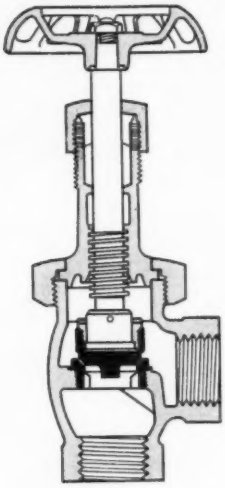
Each Valve Is Designed to Do a Specific Job. Your Operators and . . .



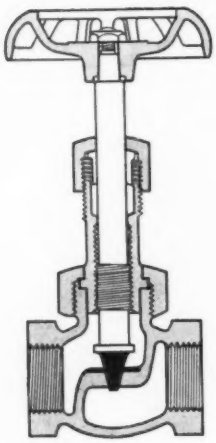
GATE
Outside screw & yoke (os&y) has a rising spindle and double disk taper-seat for sealing



GLOBE
One-piece bonnet, renewable composition disk helps this valve stay tight a long time



ANGLE
Union bonnet and regrinding bevel-disk. Save fittings by putting these at elbow spots



NEEDLE
Union bonnet with a stainless steel disk assures a tight closing and long wearing seat

"2," "4," etc. on the body gives smallest pipe size the valve should be used on. Body marked 200 WOG means valve is safe for no more than 200 psi, whether it's cold water, oil or gas.

Instead of 200 WOG, valve may be marked 125 or 125S. "S" means that this valve is for 125-psi saturated-steam pressure at its equivalent temperature of 344 F. But for "cold" service same valve may be used up to 300 psi. So temperature and pressure are important. Of course, it's dangerous to use a "cold" valve for a "hot" application.

Type and Use. Gate valve is about the most common type. It is named for wedge (or gate) that's lifted for full, free flow. But it's not designed for throttling, close-control, or quick-closing operation. One reason is disk must be opened full diameter of valve, making operation slow. Throttling also causes severe wiredrawing or wear, thus damaging seating surfaces.

Globe valve is so named because of its body shape. This valve is very popular for flow control. Reason is disk travels only a short distance from full-open to closed position, saving operator's time. Besides, wear caused by throttling is easily remedied by replacing or regrinding disk and seat. But trouble is that it restricts or offers more resistance to flow.

Angle valve is same as globe, but body is built on an angle. Use for a 90-deg turn in the line, thus reducing number of fittings needed. Then there is also less resistance to flow in line.

Y or blowoff valve has all the good features of a globe valve, but it offers less resistance to flow. It is very popular for blowing down boilers. If this or any other valve has a replaceable composition disk, it gives a little. That allows disk to adjust itself to scale and other particles. So tightness is maintained and seat protected against damage.

Needle valve resembles globe valve but has a tapered disk. Use where extremely close regulation is required. Taper fits accurately in its seat, giving drop-tight closure with very little effort.

Check valve is needed for many services. Use as a safety precaution to prevent any back flow. Or use to keep liquid in a line when pump is shut down —then it is called a foot valve. Check valve operates automatically, flow keeps it open, and gravity closes it. Two basic types are swing and lift. Use swing check in series with gate valve and operate it either vertically or horizontally. Lift check valve teams up with a globe or angle valve. It is made in three types, angle, horizontal and vertical.

Special type of lift check is called a stop check. Use on parallel boiler installations to prevent back flow, and so cut out boiler. Stem is not connected to disk and acts only as a wedge to hold disk down. Or stem allows pressure to raise the disk.

Plug valve or cock has a tapered plug with hole for liquid to run through. Plug is turned to line up with pipe openings. Plug can be opened or closed quickly. It handles thick or dirty fluids easily. But keeping it tight may be a problem.

Plug valve comes in various designs. But basically all types are the same, except for variations in stem, bonnet or disk.

Operation of all valves is based on the principle of a nut and bolt.

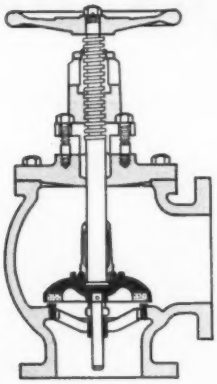
Rising stem is the simplest and most common type, used for many globe and angle valves. Also for gate valves with split wedge, allowing stem to turn.

Nonrising Stem. Here threaded disk travels up and down on stem. Because of this feature, this design is used only on gate valves.

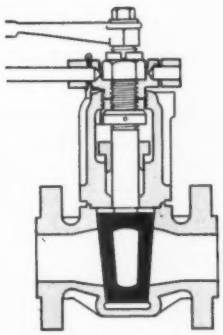
If a standard right-hand thread were used, turning stem clockwise would allow disk to "run" up, making it come off the seat. To have conventional operation, a left-hand thread is used. Then turning the stem clockwise causes disk to go down, closing the opening. Thread makes the difference between a right- and left-hand valve.

Outside screw & yoke. Here nut is turned, but it can't move up or down so stem moves without turning. Used on solid-wedge gate valves. In this type,

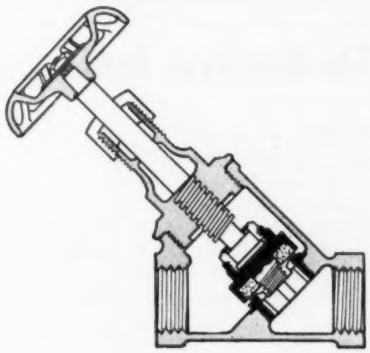
. . . Maintenance Men Should Know What They Are Made of, Where to Use



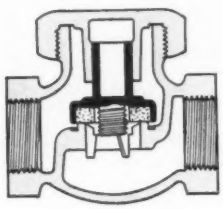
STOP CHECK
With stem open, disk opens by itself to equalize pressure, closes as check



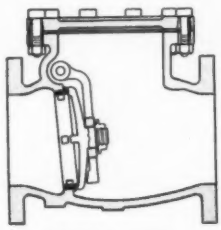
PLUG
Stick-proof plug valve is loosened before opening or closing, then tightened



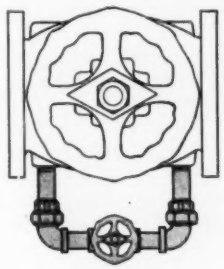
Y TYPE
This has all good features of a globe valve but offers less resistance to flow



CHECK
One-piece cap and renewable composition disk prevent back flow in the pipeline



SWING CHECK
Bolted cover, requiring disk in larger type, is used in a horizontal pipeline



BYPASS
Prevent wiredrawing the large valves by running small equalizing line, as shown

threaded section of stem is entirely out of valve body. That makes it easy to lubricate, and it is free from exposure to line conditions. Besides, you can see if valve is open or closed.

Plug valve often sticks because of very tight fit between body and plug. To eliminate this, some plugs can be raised, giving more clearance and making it easy to turn. Cone checks or very large plug valves have this feature. Besides manual operation, valves can be operated with levers, motors, gears or pistons.

Bonnet Types. Screwed-in is the simplest of the bonnet types, being of one-piece construction. Used on small, low-pressure valves, it is not good when frequent opening of the body is necessary, or where shock or vibration is common.

Union-ring bonnet is a type with internal parts that are easy to inspect, repair or service. This construction gives added strength to body against internal pressure and distortion; it's practical only on valves up to a certain size.

Bolted bonnet is most rugged type, and so is used on almost all large valves. Gasket between body and yoke enables it to withstand high pressures and temperatures.

Type of Ends. Brass, iron and stainless-steel valves in smaller sizes usually have screwed ends. Larger sizes have flanged ends. Solder ends are used when valve is to be connected to copper pipe and tubing. Steel valves may have screwed, flanged or welded ends.

Bypasses are used on steam lines to prevent water hammer by equalizing pressure and temperature on both sides of valve. Water in steam or in "dead" line causes damage if a valve is opened too quickly. Opening valve slowly to prevent this injury may damage seat and disk from wiredrawing. So open bypass valve slowly while main valve is still closed. Because bypass valve has only a small area compared to a large valve, don't worry about wiredrawing.

Maintenance. Preventive maintenance for valves simply means lubricating stem threads, if exposed, and bearing, if there is one; also, tightening down packing nut or gland flange to prevent needless leakage around the valve stem.

Extensive maintenance depends on service. Repacking may be needed while valve is under pressure. Some valves may be repacked under pressure with valve wide open.

If a valve leaks at the seat, repair it at once. If neglected, seating surfaces may be so badly wiredrawn that valve must be scrapped. Gate valve is repaired by lapping in disk and seats with fine emery cloth.

Metal disks of globe and angle valves are repaired by grinding in with an abrasive compound. Use slug, coin or pin to take up play between disk and stem, and thus keep disk from turning on stem. Disk must turn with stem to allow oscillating motion needed for grinding.

Valves with composition disks may be serviced by replacing disk insert. Right disk is needed for each job. Asbestos composition is often used for saturated steam, air, gas, hot water or condensate. Leather or rubber disks do good job for cold water or other liquids. Special soft metal is for air, gasoline or oil. You must know service for each.

OPERATORS' NOTEBOOK 65

Your Centrifuges: How

The Disk-Type Bowl

► MIXTURE of oil, water and dirt is separated by centrifugal force into three layers in oil purifier bowl. Dirt, the heaviest, is thrown against bowl's rim. Water, the next layer, discharges continuously. Oil, being the lightest, collects and is discharged nearer center.

Disk-type centrifuge has larger diameter. Liquid is thrown about same distance as depth of liquid layer. In gravity settling, shallow vessels work faster and better than deep ones. Reason is that more time is needed if particles to be separated have greater distance to travel to bottom. Same is true in centrifugal bowl.

For best results under these conditions, and with lower centrifugal force because of larger diameter, this bowl has series of disks to separate liquid into thin layers. That creates shallow settling distances between disks.

Centrifugal purifier makes use of force thousands of times stronger than gravity. If separator is designed right, centrifuge does work that gravity separation alone can't—and much faster.

Disk-type bowl travels up to 7200 rpm, is designed to take advantage of well-known principle of thin-strata distribution. Oil is fed into the bowl through a strainer cup in top, and passes down through hollow shaft to bow's bottom. From there it rises into the bowl.

Oil is thrown out toward rim. Heavy impurities hug rim. Water is thrown out against dirt, travels up and out as shown. Clean oil floats up to the top. Liquid is divided into thin layers of 0.050-in. space between disks. Disks increase speed and quality of purification. Oil passes between disks, up through holes in disk, to outlet near center. Balance between columns of oil and water is attained by using discharge ring of right size. Light oil takes larger opening in the ring than heavy oil—usually.

1 Apply brake until bowl stops. Remove cover. Lock bowl, loosen bowl ring

MORE DISKS cause solids to be forced against them sooner, doing better job

The Tubular-Type Bowl

This is the second type of liquid separator. A tubular bowl is hung from a flexible spindle, which is driven by belt and pulleys from an electric motor.

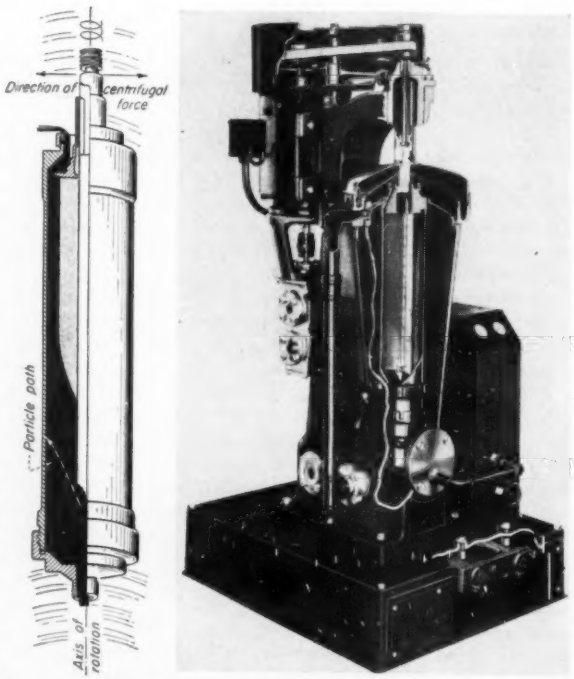
Dirty oil enters bowl at bottom, is separated, and oil and water discharge from the top into separate covers—the lighter oil into the upper cover and the heavier water into the lower. Sediment accumulates within the bowl and is periodically removed.

The bowl is designed to pass liquid from inlet to outlet with a minimum of turbulence that might interfere with separation.

Bowl turns at 15,000 rpm, developing high centrifugal force of 13,200 gravity. Bowl length, and so liquid travel, is many times settling distance. A simple one-piece, 3-wing device within the bowl brings the liquid up to speed smoothly, and keeps it from slipping within the bowl. Sketch shows straight-through path of liquid in bowl, and how particles of sediment are thrown against bowl wall.

Stress on a centrifuge bowl is proportional to peripheral speed. The smaller the bowl diameter, the greater the centrifugal force it can safely develop. The centrifugal force increases because there is greater change in the liquid's direction in the smaller bowl in a given time. There is a "sharper corner to turn."

Impurities commonly found in lubricating and fuel oil are water, sludge, dirt, carbon, bits of metal, and acid. All but acid and sludge, which are oil soluble, can be removed with either type of centrifuge.

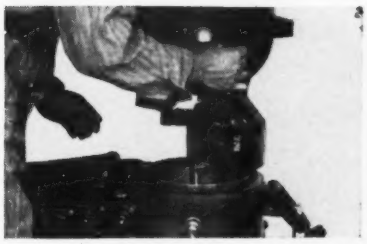


LIQUID TRAVEL is up through long bowl. Cutaway section shows the working part of centrifuge and fins in tubular bowl

To Know and Clean Them

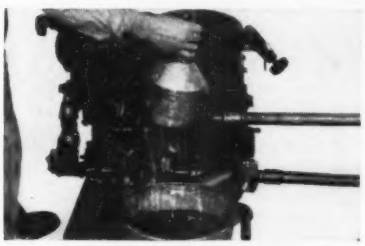
By STEVE ELONKA
Associate Editor

How to Clean



2 Unscrew bowl cover. Remove shaft and disks as unit, put in pail of solvent

3 Scrape bowl shell with scoop to loosen and remove dirt collected against rim

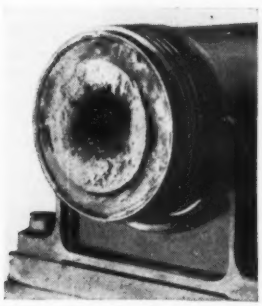


4 Replace disks (wet with solvent) in bowl. Much dirt is already washed off

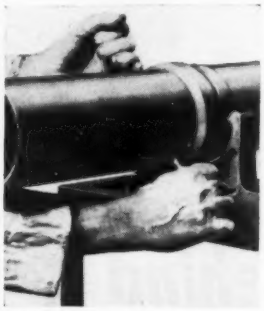
5 Reassemble bowl. Start machine without admitting oil. Run "dry" 5 min

6 Centrifugal force throws dirt off disks. Seal with water—turn on oil

How to Clean



1 Remove the cover to get at the collected solids inside

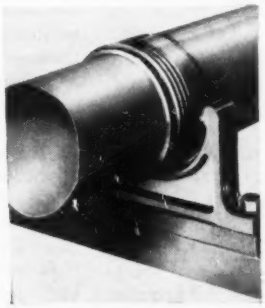


2 Screw extension sleeve onto the bowl's bottom

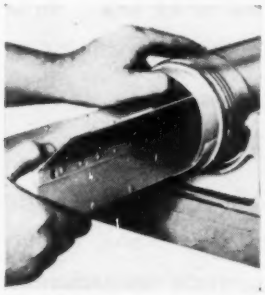
3 Lift bowl with extension sleeve above block—drop

4 Remove sleeve, pull out caked sediment as here

5 Remove solids from fins, brush dirt from the bowl

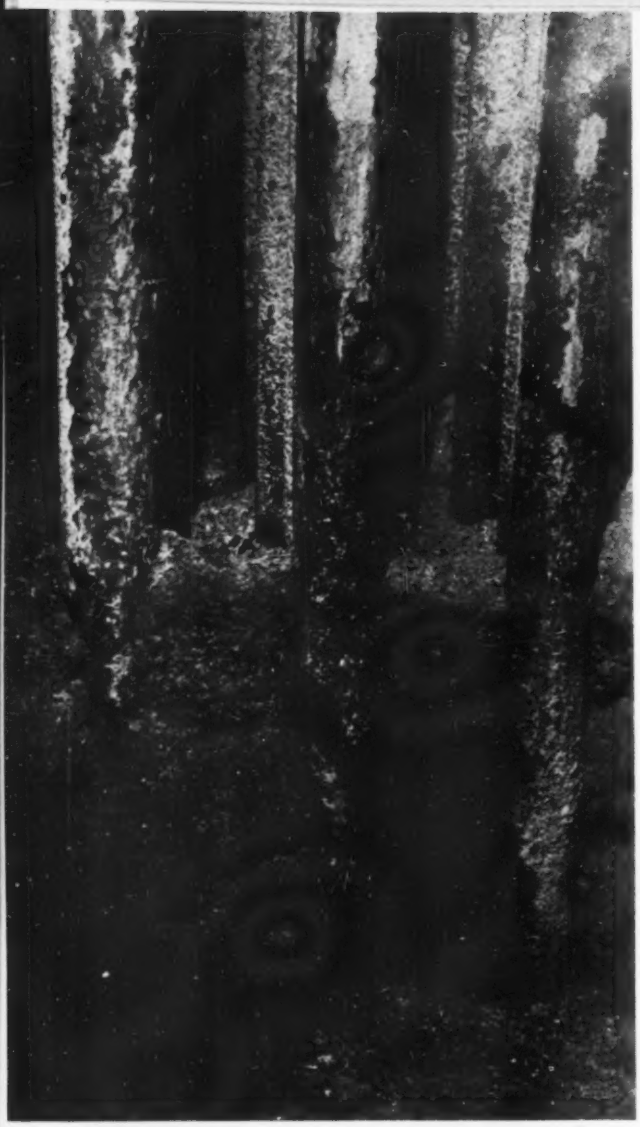


6 Roll parchment-paper liner loosely into long bowl

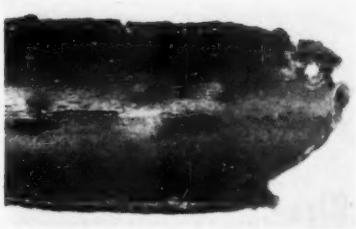


7 Push in fins (3-wing assembly) as is shown here

8 Seat fins against bowl. Screw on—tighten bottom

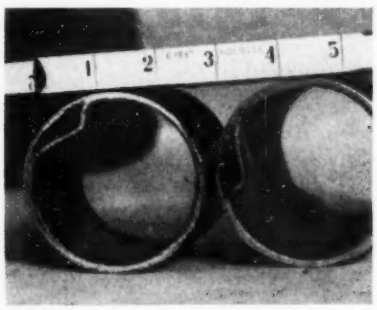


SOOT-BOUND waterwall header bracket, not free to come and go, will develop leaks, and acid in soot will make them worse



STEAM BLANKETING on watertube's top side, repeated quenching by splashing water will form bad quench cracks

EMBRITTLEMENT cracks can show up in rolled joints of welded boilers from poor rolling and water treatment



LAMINATED boiler tubing, not too common, shows that some boiler leaks have their start with bad fabrication

Get at the Cause Behind Every Boiler Leak

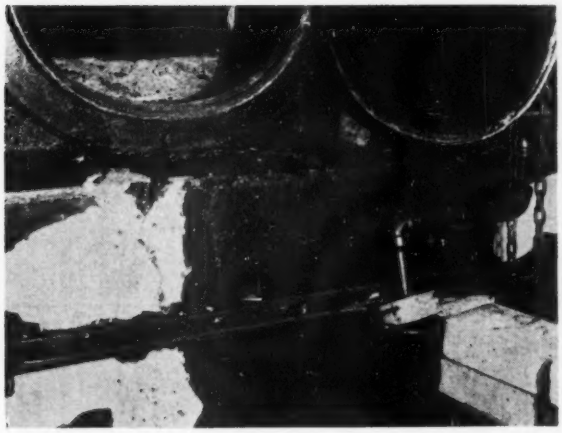
By HARRY W SPRING, *Consulting Engineer*

Boiler leaks run the gauntlet from mere nuisance to complete breakdown. But any leak, left alone, might develop serious troubles. Don't just concentrate on stopping leaks. Because they will come back, find the cause. Here are helpful hints

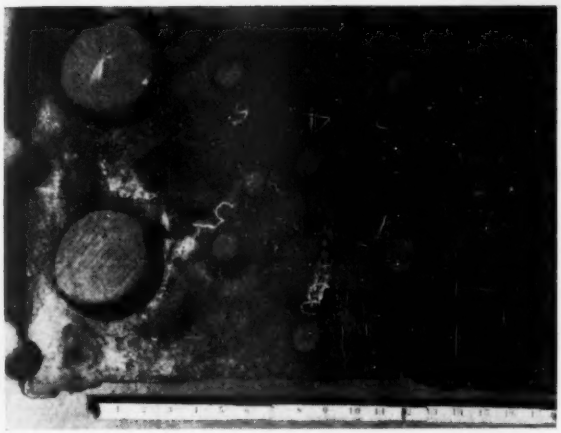
► OLD-TIME RIVETED BOILERS show leaks fast. Their commonest leakage point occurs along calking edges of plate or butt straps. Cause for this leakage at girth seams of hrt boilers is most often flame impingement, followed by overheating along metal's double thickness at the lapped plate. This is particularly true with low-set boilers that have faulty burner adjustment.

Lowering the bridgewall may help. You have to recalk the leaky joint, and we believe a light bead of seal welding applied by electric-arc process is good practice. But whatever you do, be sure to correct the burner to prevent further flame impingement.

Riveted Boiler Faults. When leaks keep popping out because of faulty calking, chip off calking edge about 1/16 to ⅛ in. deep to expose fresh



FOUNDATION cracks develop from too little room for expansion or from settling, and indicate possible future boiler leaks



PERSISTENT leaks demand investigation. For riveted parts lifting members like butt strap above reveals full trouble

Experience Identifies Leak Sources

metal for new edge. But if calking still refuses to hold, look for four faults:

1. You may be bringing your boiler from cold start up to live pressure too fast, then not holding boiler pressure steady. Several times we've run a series of stress-time curves with aid of SR-4 strain gages. Diagram, bottom of page, shows curve we've found for stress measured at longitudinal joint of a watertube boiler drum, fired from "cold start" in what the plant called "normal" procedure. Consider maximum allowable stress for low-carbon steel is 11,000 psi, and our stress curve shows loop stresses at the longitudinal joint reach 23,000 psi about half an hour after firing up. If you can hold boiler at constant pressure, these stresses drop off fast, and get back down to allowable limits. So try to set up a slow start-up period in your boiler room, then hold line pressure constant for a fair period to allow metal to relax from the critical zones.

2. Check foundation for telltale signs (photo, top left of page) that indicate not enough free expansion, contraction. Along the same lines, boiler foundation or structural supports settle, produce stresses in a drum or shell that cause calking edges to slip, then leak.

3. Faulty fabrication, like burrs left between the butt straps and shell, or rivets not completely filling the holes, or rivet holes out of round from overheating are rare trouble spots, but they can happen.

4. Cracking at riveted joints. With lap-riveted boilers, so-called lap cracks, photo at right, may occur. They happen because the shell isn't rolled to a true circle. A hinging effect develops at the offset of lap joint, produces severe bending stresses during pressure and temperature changes.

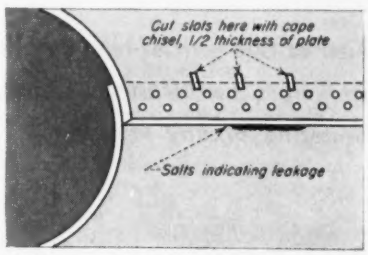
Radiographic tests give good checks on boiler metal plate up to thickness of several inches. But the tests have sensitivity limits of about 2% that may miss hairline cracks with the heavier metal thicknesses. Here, with a persistent, unexplained leak, you've got to pull out the rivets in leakage area, and swab rivet holes with hydrochloric acid applied with a toothbrush. Soak about five minutes, and flush with water.

When rivet-hole walls are dry, examine with a magnifying glass in a strong light. The acid should bring out any cracks prominently. But if you find them, you might as well scrap the drum.

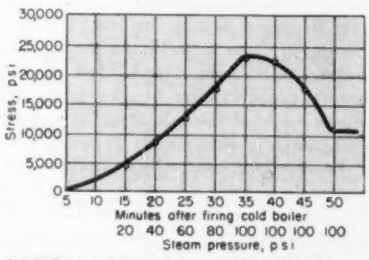
Tubular Joints. Both watertube and firetube boilers can suffer from tube-end leakage. Trouble may have started with a careless or sloppy installation. You often find tube seats scored by careless tube removal or by wiredrawing from previous tube-joint leakage. Then, too, the tube hole may be out-of-round from overheating. In all these cases, ream the tube hole true.

Tube rolling calls for highly specialized technique, and not every man has the knack. Today you can apply special mechanical aids like extrusion measurement. But the average plant may not be able to afford these aids. The only answer, then, is an experienced boilermaker who knows the "feel" of a tube roller. Under-rolling causes leakage at once, while over-rolling sets up damaging stresses that in time cause trouble.

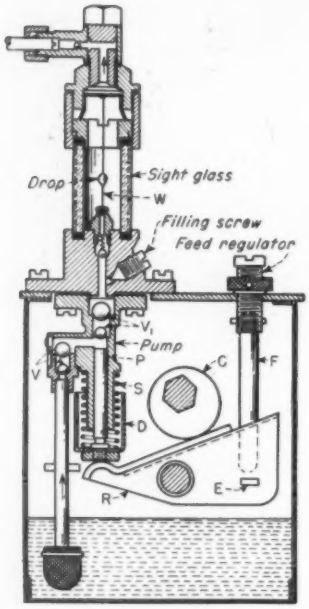
CRACKS at lap joint offset of riveted boilers come from imperfect shell roll



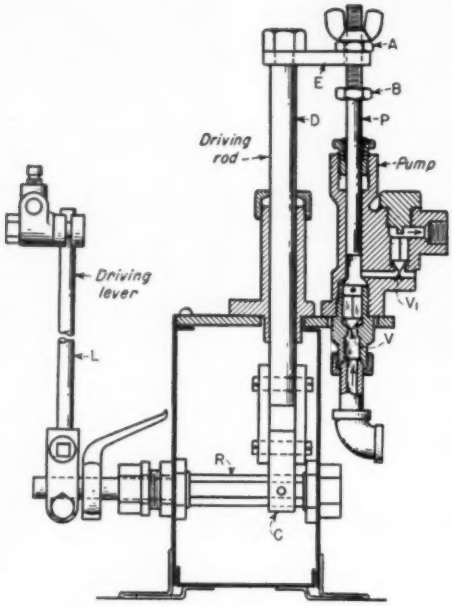
SLOT seam of leaking longitudinal joint gives hydrostatic test to show lap crack



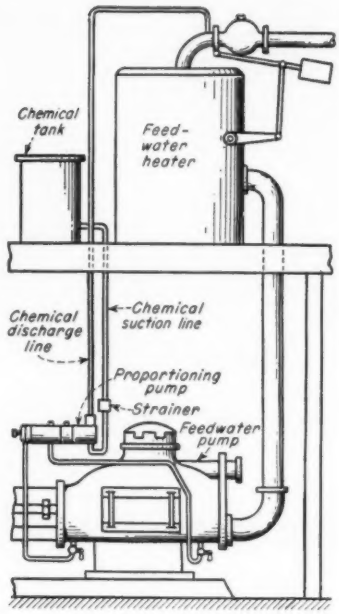
RAPID steaming of any cold boiler sets up heavy stresses through all the metal parts



1 Forced-feed lubricator is one type of adjustable-delivery pumping unit



2 This metering pump operates on same principle as lubricator in Fig. 1



3 Chemical feeder hydraulically driven from fluid end of reciprocating unit

Proportioning Pumps Deliver Controlled Drops or Gpm

First of two articles tells you how these units work, what to expect from the different designs. If you have a job needing fluid metering of any kind, read this report. Its coverage is tops

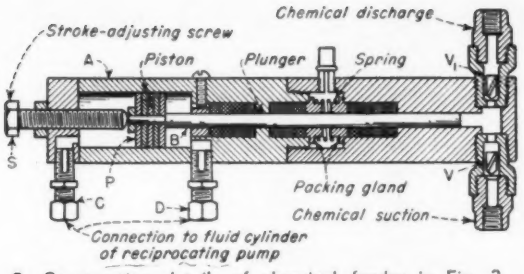
By F A ANNETT
Contributing Editor

► PROPORTIONING PUMPS are available for discharging chemicals to water and other fluids, mixing chemicals, and many other jobs. Today, designs with a variety of control types are in use. They may be power driven, run from another pump, or from a meter or measuring device to do almost any kind of accurate proportioning at any pressure. When made of suitable materials, units can handle a wide variety of chemicals.

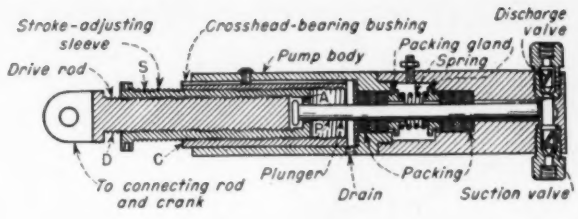
Forced-Feed Lubricators. Though not generally considered so, a forced-feed lubricator is an adjustable-delivery or proportioning pump. In fact, many chemical-proportioning pumps have a smaller capacity and operate at lower pressures than some lubricators. Fig. 1 is a cross-section of one lubricator type. Its adjustable-stroke plunger pump is operated by rocker arm *R*, actuated by eccentric *C*.

In position shown, the eccentric has pushed the right-hand end of rocker arm down, and left-hand end up. This pushes up plunger *P* to discharge oil through ball valves V_1. While eccentric turns 180 deg, spring *S* pushes plunger down for suction stroke and oil flows into cylinder through ball-suction valves *V*, ready to be discharged on next upstroke. Amount of oil delivered is shown in the sight glass, which is filled with a mixture of water and glycerin, or glycerin only, and is designed for 1500 psi. Wire *W* guides oil drop slowly through center of glass.

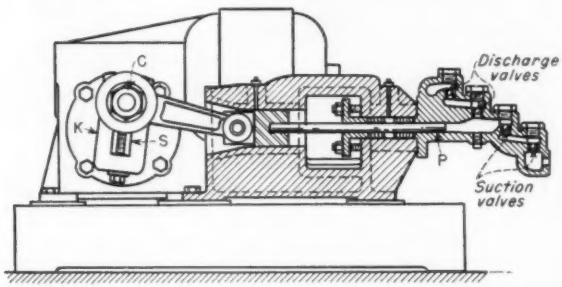
Oil Seal. Spring cup *D*, fastened to end of pump plunger, acts as a guide for the spring and a container for oil to form a seal against air being drawn into pump. Stroke length and amount of oil delivered per stroke is controlled by feed regulator *F*. It contacts an extension *E* on rocker arm *R* to limit movement and stroke length. Entire working mechanism, including ratchet or rotary-drive parts, is inside the oil reservoir and self-lubricated. These lubricators may be grouped in any number in a single tank.



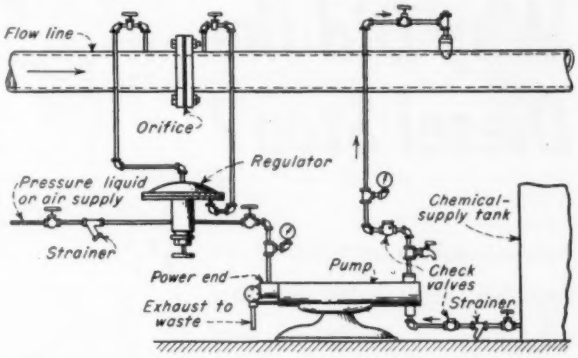
4 Construction details of chemical feeder in Fig. 3. This has a power cylinder in which piston connects to plunger



5 Motor-driven variable-stroke chemical pump has a free-floating plunger, runs at a speed of 60 strokes per min



6 This motor-driven chemical-feed pump has a plunger whose stroke is adjusted by screw S at the unit's driving crank



7 Self-propelled pump is operated by water or air pressure. It is hooked up here for corrosion control in a steam line

Chemical Feeders. Metering pump or chemical feeder, Fig. 2, works much like the lubricator, Fig. 1. All its pumping parts are made of materials suitable for the chemicals handled, and are outside the case enclosing the operating mechanism. Plunger *P* is connected by a lost-motion adjustment to driving rod *D*. There is a linkage between crank arm *C* on rocker shaft *R* and drive rod *D*.

This unit may be mounted on a direct-acting boiler-feed pump, and run through driving lever *L*, connected to the feed pump's piston rod or valve gear. Reciprocating motion of the feed pump's piston is transmitted to rocker shaft *R* to drive plunger *P* up and down. On upstroke, chemicals are taken in through suction valve *V*; on downstroke, they are forced out through discharge valve V_1.

Stroke length is determined by lost motion between adjusting nut *A* and fixed nut *B*. If connection between driving rod *D* and plunger is clamped between nuts *A* and *B*, plunger makes a full stroke and the pump runs at a capacity corresponding to its speed. When the nuts are separated so connection *E* can move up and down without touching them, plunger *P* remains at rest and capacity is zero. Any capacity between zero and rated is obtained by positioning nut *A*.

Since boiler feed pump drives this unit, it discharges treatment into boiler water in direct proportion to feed pump's speed, or to the rate of water flow into boiler. Generally, chemical tank is mounted on and above chemical pump so there is a positive suction head.

Besides being driven from another pump, this unit can be powered by a ratchet motion or by a rotary drive using either a belt or an electric motor. Capacities with ¼- to 1-in. plungers range from 1 pint to 17.5 gal per hr at pressures to 5000 psi. Actual discharge of pump depends on stroke adjustment.

Synchronous Drive. Instead of driving pump by direct mechanical means, as in Fig. 2, it may be driven hydraulically, Fig. 3. With this hookup the chemical pump makes a stroke every time the feed pump does. Chemicals are delivered to the feedwater in proportion to feed pump's speed. Chemical pump's piston moves in synchronism with main pump but makes one-half or one-quarter the number of discharge strokes, depending on whether main pump is simplex or duplex.

Fig. 4 shows a cross section of the chemical pump in Fig. 3. Piston *P* in power cylinder *A* connects to chemical-delivery plunger *B*. Pressure take-offs from end of main pump's fluid cylinder connect to chemical pump's power cylinder at *C* and *D*. Pressure impulses of main pump are transmitted to chemical-pump's plunger, causing it to reciprocate in step with driving unit. Any change in main pump's discharge rate changes pumping rate of proportioning pump.

Screw *S* in cylinder head adjusts stroke to vary chemical feed. Suction and discharge valves *V* and V_1 are heavy plug type, with rifled ports to cause the valves to rotate for self-cleaning of seats, walls and wings. Spring-tension packing glands eliminate usual packing nuts and automatically take up packing wear.

Self-Propelled Unit. Many proportioning pumps are power driven separately from the main pump. Fig. 7 shows one, classed as a self-propelled type, connected to supply chemicals to a steam line for corrosion control. Power end has a reversing mechanism or valve gear consisting of a small reversing valve attached to the piston rod. It operates an auxiliary liquid or air piston to drive the pump from a pressure liquid or air supply through the main reversing valve. Pump response is like that of the unit in Fig. 3.

Any liquid or gas, like water or compressed air at sufficient pressure, drives the pump. Plant or city water may be used as a power source independent of fluid pumped. Regulator, connected across an orifice in flow line, controls

(*Continued on page* 180)

Why Did the Diesel Stop?

Lube-oil salesman blamed the engine's bad habit on fuel oil, but our trouble shooter had a few aces up his sleeve

By **LEONARDO B VILLARTA**
Oroquieta, Philippine Islands

TALK ABOUT a madhouse. The mechanics were trying to bar that frozen engine over, I was checking the log book for hidden clues, and the lube-oil salesman was talking with the manager. This salesman was trying hard to lay all the engine trouble on the fuel oil, sold to this large hemp plant by his competitor

► WHILE WITH a diesel-engine sales firm in the Philippine Islands, I was asked by my superior to find why a 120-hp 2-cycle 2-cylinder heavy-duty German diesel gave trouble. The engine was in a hemp-rope factory on the outskirts of Manila. It was the only source of power; therefore, the unit was very important.

Trouble. When I arrived, some men were taking the cylinder heads off the engine. The engineer in charge told me that recently the engine had acquired the bad habit of stopping by itself. It had stopped a number of times. And it was usually between twelve noon and two in the afternoon. The peculiar thing was that the men had only to give the flywheel a few turns, and the engine would start up again without very much trouble.

But the day I got there, the engine would not start, and that was that. We opened the crankcase, suspecting a bearing seizure inside. But we could find no trouble. After the cylinder heads were off, we did find the inside wall of one cylinder very dry. Fact is, it appeared burned. It was also deeply scored all around its entire diameter. And the piston had stuck at the bottom of the cylinder.

Frozen Piston. To help loosen the piston, I ordered the men to pour in a gallon of native vinegar. While waiting for the sour liquid to work its way between piston and cylinder wall, I carefully inspected the fuel-oil injectors in the cylinder heads. I checked condition of nozzle tips, combustion chambers, piston crowns and exhaust portholes.

The engineer, in the meantime, carefully examined the automatic lubricator and found it in perfect condition. Then I made sure there were no telltale signs to show the sticking piston resulted from fuel nozzle, or chemical action of fuel oil.

Log Book. Satisfied, I asked for the engine log book. I went over every page carefully, especially noting the outlet cooling-water temperatures. Then I discovered a peculiar thing. In spite of peak loads a few days before the mysterious engine stoppings, outlet-water temperature hadn't increased even slightly. Not only that. The records showed temperature came *down* a trifle two days before the engine stopped the last time. This was something.

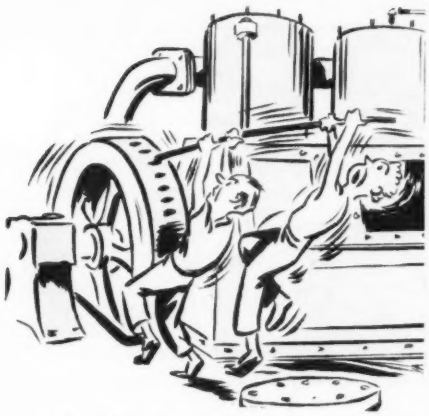
These findings gave me a definite clue. After about two hours from the time we poured vinegar into the cylinder, the men were able to turn the flywheel a little. I instructed them to keep racking the flywheel to and fro, and to squirt cylinders with lubricating oil at the same time. After half an hour of racking, the piston was finally free.

Salesman Enters. During this time an oil salesman visited the plant and talked with the manager. I learned a little later that although the lube oil used in that engine was bought from this man's firm, the fuel oil was supplied by another company.

When this salesman learned that the engine trouble was piston seizure, he forgot to use caution, jumped to a conclusion, and laid the blame on the fuel oil. That conclusion is often justified out here because there is plenty of trouble in the Islands from fuel oil.

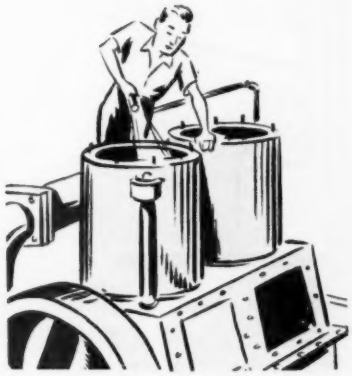
Fuel OK. I told the manager that the fuel oil was no more to blame than the lube oil. To prove my point beyond any doubt, I took a ¼-in. steel rod about four feet long. Then I shoved it through the water jacket of the good cylinder. The rod went through, right down to the

Everyone Had His Own Theory, but the Cooling Water Caused the Trouble



1 When engine stopped every few days, mechanics would bar over flywheel

2 This time the diesel wouldn't start. And so I had them open up the engine



3 Inside of cylinders showed that high heat burned lube oil, causing trouble

jacket's bottom. I made the same test on the stuck cylinder. But to everyone's surprise, I couldn't poke the rod more than six inches into the water jacket. The jacket was plugged almost solid with hardened sediment.

Bad Water. Cooling water used in the engine came from a nearby river. But the river was turbid, especially during the rainy season. That still didn't answer one question. If mud plugged No. 2 cylinder's jacket, why was jacket of No. 1 almost free of sediment? Only answer was that more water flowed through one jacket than through the other. Also, velocity through the free jacket was higher than through the plugged one.

Piping System. That's when I examined the cooling-water piping system. BEFORE sketch, below, shows how I found the piping. From that I reasoned that No. 1 cylinder, being nearer, caused less friction; therefore, water flowed faster and didn't plug. But circulation through No. 2 was so slow that sediment had a chance to settle. Then cylinder was overheated, burning cylinder oil and eventually seizing piston.

Sketch labeled AFTER shows how I had them change piping. That equalized water so same amount flowed through both jackets. Also, with thermometers at both outlets, temperature rise could be noticed before piston seized. Besides these improvements, I had them install a large settling tank so most sediment settled to the bottom before going to the engine.

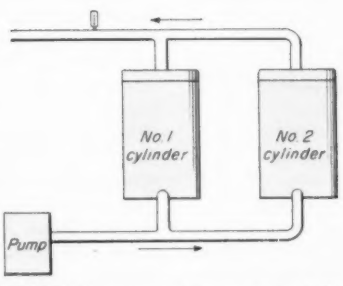
Results. I visited this plant after changes were made, and the engine had not stopped once mysteriously. Since then, I've suggested these changes to other diesel plants in the Islands because the water supply is not always ideal here, especially in the provinces that are more backward.

4 We poured native vinegar inside the cylinders so engine could be turned

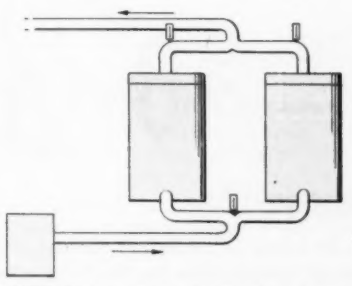
Changing the Cooling Piping Solved This Problem

Piping to No. 2 cylinder was farther away from pump. So it offered more resistance to flow. Because water didn't move as fast through No. 2, mud had more time to settle. Then because cylinder wasn't cooled enough, lube oil burned off walls and finally the piston froze. Solution was piping the cooling water so flow resistance was equal through both cylinders, as shown.

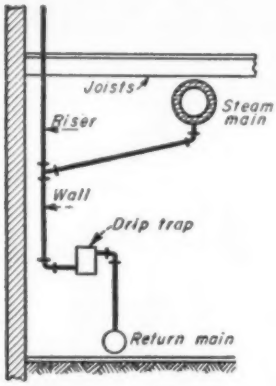
EDITOR'S NOTE: *This could also have been done by having a larger-diameter water inlet and outlet header.*



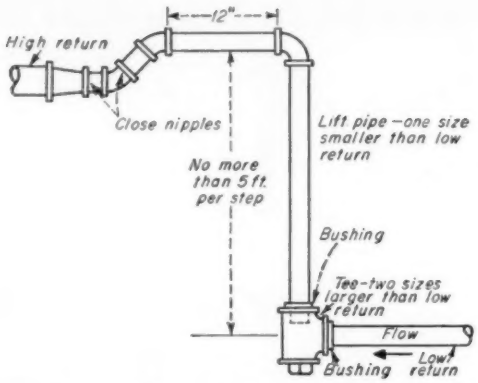
BEFORE Water moved faster through No. 1 cylinder so less mud settled out in it



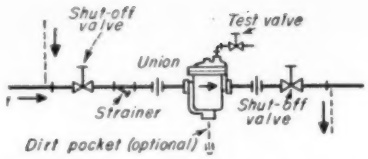
AFTER This piping equalized resistance through both cylinders, solving problem



PROPER installation of piping, returns cuts down on your maintenance headaches



LIFT fittings make it possible to raise condensate over various building members



TESTING auxiliaries should be a simple procedure that fits right into operation

Long Life For Auxiliaries Is a Design Problem

Put Heating-System Maintenance On a Long-Range Operating Program

Here's a somewhat different approach to heating-system upkeep. It's based on an operating background that takes into account expected useful life of system auxiliaries

By **THOMAS J BARRETT,** *Building Supt, Waldorf-Astoria Hotel*

► HEATING-SYSTEM MAINTENANCE is no part-time job for any large steam user. It involves three major steps—testing, replacing, modernizing. Behind each of these steps there ought to be a well thought-out program and, most important, a final judgment on whether the costs, direct or indirect, are worth the candle.

TESTING

Let's look at the first of our steps, heating-system testing. In the hotel business our final test is the guest's satisfaction. He's usually looking for the best in comfort, and is quick to call us if he thinks we're falling down on the job.

To our mind, the best and only answer to his questionable judgment is a good zone control, monitored by an outdoor thermostat. It gives you an absolute reference point, and safeguards you against getting your whole heating system out of whack to oblige an isolated few. Yet it does take into account the fact that direct sunlight hitting one zone greatly changes that zone's need for heat from your central plant. It wasn't too long ago that we ignored this fact.

When it comes to testing the parts of a heating system, like traps, expansion joints, valves, piping, we consider maintenance so much a part of operation that we set up no hard-and-fast rules. For example, many trap manufacturers recommend monthly to annual tests for all traps throughout a system.

We feel differently about this. We believe the extent of our testing should be the simple, easy checks an operator can make on his regular rounds. To that end we put in the usual shutoff valves before and after the trap, protect it with a strainer ahead, and then install the trap with union fittings before and after. On each trap that permits it, we put a test valve.

We also school the operator on what to expect when he opens that test valve, or how to make a rough temperature

check with his hand before and after a trap. If he gets anything different when he makes his quick check, like a steady blast of steam from a bucket trap or a continuous flow of condensate, he reports trap trouble at once. Right here is where we depart from the usual practice.

We buy all our traps from a single manufacturer. You'll see why later when we talk about replacement and installation. With this buying policy we've found traps protected by strainers give pretty satisfactory service for their normal life. When one goes bad we yank it out and stick in a replacement. Then we scrap the old trap. We figure it has probably seen its best days anyway.

Sure, we know manufacturers give a good set of instructions for inspection and repair. We've found, though, that we've had mighty few trap failures to begin with. Then only a couple out of those few are troubles our shop can fix up. So we feel it is cheaper in labor and in parts inventory to junk our ailing traps. And that's what we do today.

Some of our engineer friends have argued this point with us, but stop and think. If you've got valve or seat trouble, you should remember never to use a new seat with an old valve, or the other way around. Or you should run rather delicate checks on thermal buckets, or bellows. We say for the very few traps you'll save, for maybe another year or so, you'll be money ahead by junking each one and replacing it with a new trap whose life expectancy is probably years more.

PIPING CHECKS

When troubles show up on maintenance of piping and fittings, we blame most of them on design or installation. We feel the first fundamental in heating-system design is to be sure condensate returns flow by gravity even if you plan a vacuum pump such as we use. We correct with drip connections any shifts in pitch of piping runs that come to our attention, or indications of too few drips or drains, made evident by water hammer banging away. Now and again, you hear of horizontal steam-supply mains acting up from condensate slugs.

The first drawing, p 120, is an excellent way of handling this problem. It gathers the condensate from the bottom of the pipe and returns it directly to the return line. We're strong believers in dripping individual risers as a definite aid to a better heating system.

What's more, we personally like the vacuum-return system because it gives us positive action. Then, too, it helps solve the occasional condensate-return problem of lifting condensate over building structural members by letting you use lift fittings, middle drawing, top of p 120.

We've always felt there are a flock of disadvantages in using an ordinary trap to lift condensate to a higher level. We know it can be done and you explain it by the fact that the steam pressure inside the equipment the trap is draining supplies the energy to raise the condensate. But the limitation on how high you can lift condensate by this method, plus the difficulties in warm-up periods, is enough to discourage us. We just don't think there's enough pressure available when you need it most.

Expansion joints are a particular maintenance problem with us. Our piping system is getting along in years. So we've been replacing runs with wrought iron, and are gradually making headway. Where expansion room seems in order, we're putting in loops in place of the old corrugated joints.

The failure of these parts is probably due to two things —their age and possibly some corrosion attack from dissolved gases in the returning condensate. Occasionally we've had the vacuum on our vacuum pump drop off fast. By now we know it's one of our older corrugated expansion joints splitting, and we shut down different risers until the vacuum climbs back. This way, we isolate the riser at fault and get to work on it quickly. If space allows, we put in a loop.

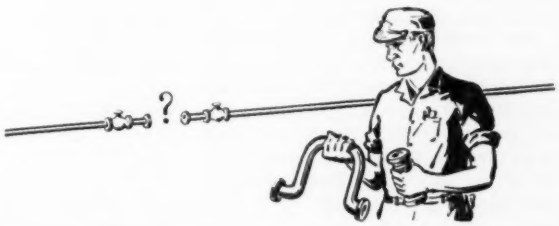
INSTALLATION, REPLACEMENT

All the way through these comments on piping checks and heating-system tests we've been working in something on replacements, like the loops instead of corrugated expansion joints. Their only purpose is to give us longer life, less maintenance.

There's nothing quite like a sound, engineered installation to cut down on later maintenance. And as a part of a sound installation we believe you ought to look ahead to replacements by right equipment selection and location in your system.

This means in getting equipment, like traps, for example, order from one manufacturer and standardize on that selection. That way you can insist on the right size and design trap for your system with assurance that the manufacturer will check and confirm your selection. Next, when a trap fails, your men can pull a duplicate trap out of stock. You know it will be the same as the one it replaces. Any engineer who has ever run a sizable steam system will tell you that pipefitters have a habit of replacing traps by pipe-fitting size. And in a system as big as ours we can't be standing by for occasional trap replacements.

Next, locate traps in the right place, that is, close to drip points and below them where possible, but in a spot where you can get at them to test or replace easily.



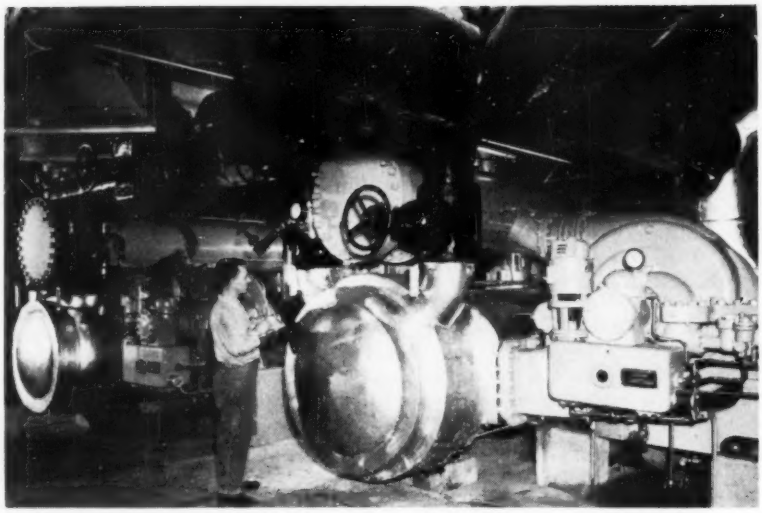
MODERNIZATION

To our way of thinking, the last phase of a good heating-maintenance program is modernization. Standardizing on equipment may not look like a good start. But we don't consider it any handicap. If anyone shows us a piece of equipment that will do a better job than we get with what we're using and the improvement is large enough to justify the cost, we're for it.

We mean particularly developments in engineering practices like the use of amines to protect condensate-return systems from corrosion. Or, possibly, some of the newer ideas of spotting newer, differently designed heat-transfer equipment like convectors under large windows to offset the heavy cold-wall losses from greater and greater use of glass.

Here are seven easy-to-use formulas to find capacity of your system, be it direct or indirect type. Study the problems solved for you so you'll be ready for some fast checks

By D K CHAPMAN
Service Engineer, Worthington Corp



CENTRIFUGAL COMPRESSORS serving large refrigeration load in a hotel. There are many useful checks you can make on system performance by using hints given here

Easy Figuring Helps You Check Out Refrigeration for Air Conditioning

► TWO TYPES of refrigeration systems may be used with air-conditioning units —direct and indirect expansion. *Direct* has evaporator coils in air stream. Expansion valve in coil regulates refrigerant flow. *Indirect* has evaporator coils that cool water or other liquid pumped through the air-conditioning unit.

Spot Checks. You can check refrigerating-machine performance in several ways. With each you must use some simple arithmetic—but don't let that scare you. Just follow the formulas and steps we give below. They're accurate enough for all ordinary jobs. You can figure some results closer, but the extra work needed really isn't necessary unless you're designing a plant.

System Capacity. On trouble shooting and other jobs you often benefit from knowing actual capacity of a system that cools chilled water for air conditioning. Most systems like this have a water chiller in which refrigerant expands in a coil. Water passes through chiller shell. But you can use same method for a flooded-type chiller, too.

Figure the capacity from $C = 0.042$ gpm $\times$ t_a, where C = tons refrigeration; gpm = gallons of chilled water circulated per minute; t_a = temperature difference between water entering and leaving the system's chiller, F.

If you don't have a flowmeter to measure chilled-water flow, multiply difference between suction and discharge pressure-gage readings of circulating pump by 2.31. This gives pump head in feet. Refer to characteristic curve for pump, read gpm corresponding to that head. Diagram, right, is a typical characteristic curve for a centrifugal pump.

To estimate gpm from curve you must know both the head and horsepower of pump. Easiest way to find pump hp is to use a clamp-on wattmeter to measure input watts. Divide reading by 746, and multiply result by 0.80 and pump efficiency, read from the characteristic curve. (The value 0.80 is the assumed motor efficiency, 80%, expressed as a decimal.)

Remember, you must use the characteristic curve for the pump in your system. Diagram is only an example of a typical centrifugal-pump curve.

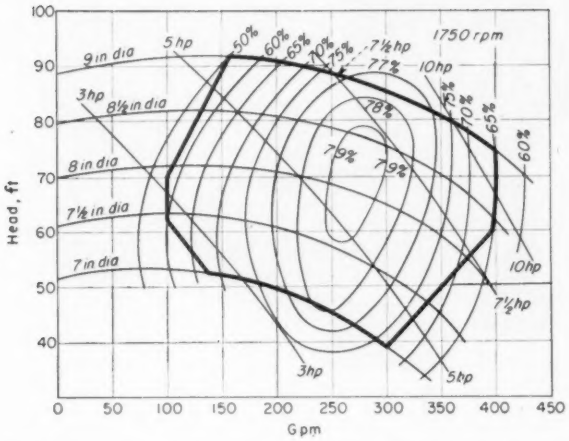
Direct-expansion systems may be figured in three ways if you wish to check over-all capacity of system. These are: (1) measuring total heat removed from air passing through coil (2) measuring heat rejected to condensing water (3) separately measuring sensible and latent heat removed from air.

Sensible-heat removal results in a change of air temperature while latent heat comes from moisture that condenses out of the air. Method 2 is equally good for direct and indirect systems.

Total Heat. To figure total heat removed from air passing over a coil use this equation: $H = 4.5 \times$ cfm $\times$ h_d, where H = total heat removed from air, Btu per hr; cfm = cubic feet of air passing over the coil per minute; h_d = enthalpy difference between entering and leaving air, Btu per lb.

Obtain air enthalpy from a psychrometric chart or the table, right. Read enthalpy at the air's wet-bulb temperature, not the dry-bulb. Once you've figured total heat removed by refrigerant, convert this to tons refrigeration by dividing by 12,000 Btu per hr per ton. If wet-bulb temperatures you're working with are above or below those in table, see a standard reference book such as ASH&VE *Guide*.

Measure air velocity with a velometer, if possible. This gives velocity readings directly. Convert to cfm by multiplying average velocity, obtained from 10 or 12 readings across the duct, by duct area in square feet. You can also use a pitot tube to obtain air



TYPICAL characteristic curve for a centrifugal pump in an air-conditioning system. Don't use this chart for figuring

Quick Check List for Air-Conditioning Refrigeration Systems

Item	*Range*
Condensing-water inlet temp, F	60-95
Condensing-water outlet temp, F	85-115
Water-temp rise in condenser, F	15-25
Freon-12 head pressure, psig	100-150
Freon-12 suction pressure, psig	25-50
Temp air enters cooling coil, F	75-90
Temp drop through cooling coil, F	12-25
Temp air leaves cooling coil, F	50-70
Air circulated per ton refrigeration, cfm	300-600
Room temp for comfort cooling, F	70-86
Condensing water, gpm per ton	3-5
Temp chilled-water enters coolers, F	50-65
Temp chilled-water leaves coolers, F	40-50

velocity. It's often handy when a duct opening isn't accessible. Be sure to follow instructions provided with these instruments when taking measurements.

Heat rejected to condensing water is figured from $h = 500 \times \text{gpm} \times t_a$, where h = heat to condenser water, Btu per hr; gpm = gallons of water passing through condenser per minute; t_a = temperature rise of water through condenser, F. Deduct 10% of the figured heat to get actual heat rejected because this much heat in condenser water comes from what's called "heat of compression." This is heat from work that compressor must do to raise the pressure of the vapor. Divide result by 12,000 to convert to tons refrigeration.

Don't forget that if compressor is hermetic type, having motor winding cooled by suction gas, this heat is also rejected to the condenser water. So we must deduct the Btu equivalent of motor heat, or motor hp $\times$ 2544, from heat load on condenser. Treat fan motors in the cool air stream the same way.

This figuring is good for all shell-and-tube condensers. Use a flowmeter or measuring barrel to find water flow in gpm. On large jobs where it's tough to measure flow accurately with a barrel, install pressure gages on inlet and outlet of condenser water pump. Multiply difference in readings by 2.31 to find total head in feet. Read gpm from pump characteristic curve, after figuring motor hp as shown above.

Evaporative condensers are figured by method 1 above, except that we're dealing with an air-temperature rise instead of a drop. Also, we must subtract heat of compression (10%) and electrical heat, if any.

Total sensible heat is found from $h_s = 1.1 \times \text{cfm} \times t_a$, where h_s = total sensible heat removed from air, Btu per hr; cfm = cubic feet of air cooled per minute by refrigerant; t_a = temperature difference between air entering and leaving coil, F.

Figure total latent heat from $h_l = 8750 \times \text{gph}$, where h_l = total latent heat removed from air, Btu per hr; gph = gallons of moisture condensed from air per hour. Add total sensible and latent heat to find amount of heat the coil removes from air.

Enthalpy of Moist Air

Wet-bulb temp, F	*Enthalpy, Btu per lb*
68	31.92
69	32.71
70	33.51
71	34.33
72	35.17
73	36.03
74	36.91
75	37.81
76	38.73
77	39.67
78	40.64
79	41.63
80	42.64
81	43.67
82	44.72
83	45.80
84	46.91
85	48.04

You have enough methods here to make a good spot check on most jobs you run across. But since they are all subject to a little inaccuracy, depending on conditions, your best bet is to figure the job in several ways and take the average of your results.

For quick checks of refrigeration systems use the list shown above. Ranges given are typical, and you'll find them valid for most jobs you're called on to trouble-shoot.

Examples. Here are several typical problems showing how to use the equations above.

Example: A compressor chills 100 gpm of water through a temperature range of 20 F. What is compressor capacity at this load?

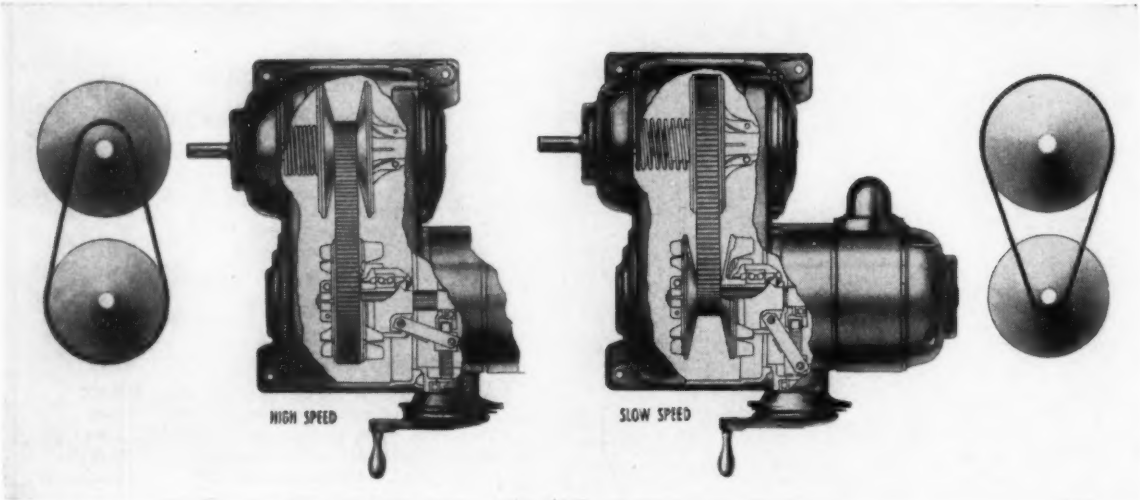
Solution: Use first equation; $C = 0.024 \times 100 \times 20 = 48$ tons.

Example: Air enters a coil at a wet-bulb temperature of 80 F, leaves at 70 F. What is compressor tonnage when 1000 cfm flow through coil?

Solution: Difference in total heat, using values from table, is $42.64 - 33.51 = 9.13$ Btu per lb. Put this in equation to find total heat removed as $H = 4.5 \times 1000 \times 9.13 = 41{,}085$ Btu per hr. This is 41,085/12,000 = 3.43 tons of refrigeration.

Example: What is the capacity of a refrigeration unit using 30 gpm of condensing water when temperature rise through condenser is 20 F?

Solution: Using method 2, $h = 500 \times 30 \times 20 = 300{,}000$ Btu per hr. Subtracting 10% for heat of compression, quantity of heat rejected to cooling water is 270,000 Btu per hr and tonnage is 270,000/12,000 = 22.5 tons.



1 Spring-loaded variable-cone transmission with an integral motor drive. Motor speed remains constant while output speed is changed by varying the relationship of reciprocal-diameter pulleys. Unit provides infinitely variable speeds

Mechanical Variable-Speed Transmissions: III

Last month we discussed three of the four classifications of commercial transmissions. The fourth, an enclosed unit with variable cones, is the most popular. Here's how this type gives you almost any speed you want

By **W L BYLER**, *North Wales, Pa.*

► THERE ARE four popular variable-speed transmissions of the enclosed variable-cone type. Each uses the basic principle of a V-belt running between two pulleys mounted on parallel shafts.

While these transmissions operate on the same general principles as the variable-pitch and floating-pulley units, considered last month, the arrangement is different. Instead of having one variable-pitch and one fixed-diameter pulley with changing center distances, the present transmissions have fixed center distances, and both pulley diameters change.

Output speed is infinitely variable within the designated range (see table, p 125). Each type described below is easily identifiable.

Spring-loaded transmission, Fig. 1, is simple in construction. Unit illustrated has an integral motor, can be arranged for either horizontal or vertical mounting, as desired.

When the control wheel is turned to the right, the screw and pivoted strut move the sliding cone disk on motor shaft toward its companion. This positive adjustment forces the V-belt to a larger diameter. Simultaneously, the belt forces the sliding cone disk on the driven shaft to retract against its spring so the belt runs on a smaller diameter on that shaft. Speed of driven shaft increases in stepless increments while motor speed is constant. Reverse movement of the handwheel reduces output speed.

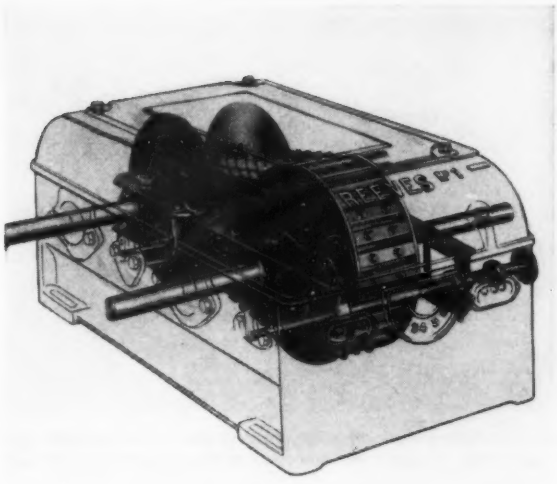
Advantages claimed for the spring-loading feature include the following: (1) Calibrated spring maintains pressure between both driven cone disks and the sides of belt. (2) Spring tension balances wedging action of belt tension, regardless of wear, temperature, or other changing operating conditions. (3) Spring compensation establishes proper variable disk center distance on the driven shaft. This establishes exact belt tension. (4) Load shocks are relieved by resiliency of V-belt and spring. Output shaft rotates smoothly, free from shocks and vibrations. (5) Speed control as fine as 1 rpm is claimed from no load up to operation at full load.

Positive lever-adjusted transmission, Fig. 2, is another well-known design with the same basic operating principle. There are two pairs of adjustable cone-faced disks mounted on parallel shafts. Two levers, pivoted midway between the shafts and controlled by a screw, control lateral motion of the disks.

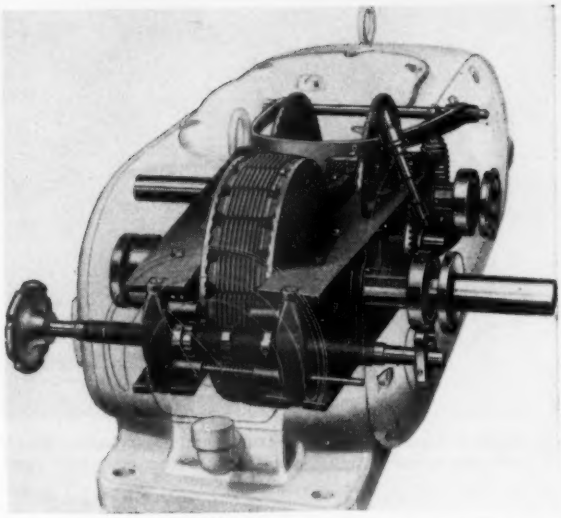
Turning the screw clockwise separates the levers, and disks on the nearest end draw apart. Between them belt runs on a smaller diameter. Simultaneously, the levers and disks on opposite end come together, so the belt runs over a larger diameter. Turning the screw counterclockwise reverses the effect.

Either shaft can be used as constant-speed input, with variable, stepless output speeds on the other shaft. Both horizontal and vertical mountings are available for floor, wall or ceiling. Manufacturer produces both enclosed and open designs.

Advantages claimed for the pivoted-lever design feature include the following: (1) Each speed setting is held



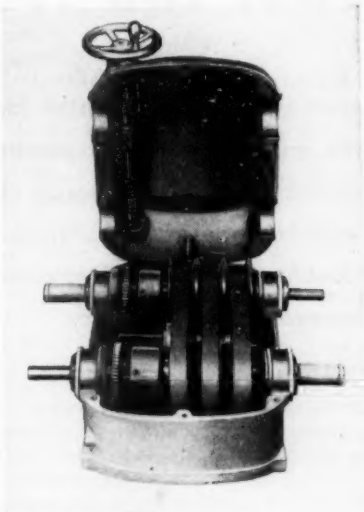
2 This variable-cone transmission uses two screw-controlled levers for changing pitch diameters, varying output speed



3 Positive-infinitely-variable transmission has floating chain slats that mesh with radial slots cut into the pulley disks

Characteristics of Variable-Speed Transmissions

Enclosed variable-cone type	Hp range	Speed range
Spring loaded, belt	¼ to 50	4:1
	¼ to 1	10:1
Lever adjusted, belt	¼ to 87	2:1
	¼ to 40	4:1
	1 to 50	8:1
	10 to 12	16:1
Self-tooth-forming, chain	½ to 25	6:1
Multigroove, V-belt sheave	1 to 7½	3.75:1
	5 to 30	3.25:1
	10 to 75	3:1



4 Multiple V-belts operate this unit. Worm gears change pitch diameters

without fluctuation because belt tension is positively maintained at all driving diameters. (2) An equalizing link maintains uniform tension on V-belt regardless of speed position. Belt-tension-adjusting screw locks in position. (3) Endless V-belt is clamped between hardwood blocks tipped with leather to prevent crushing belt and provide for accurate speed resetting. (4) Load-equalizing collar provides 4-point universal suspension of each thrust bearing. (5) Operation is practically noiseless.

Positive infinitely-variable transmission, Fig. 3, is unique because it is the only device using a self-tooth-forming chain. This chain provides positive engagement rather than depending on friction for transmitting power. The transmission is an all-metal unit, fully enclosed. All the moving parts run in or are splash-lubricated from a common oil reservoir.

The multilinked chain has steel laminations that shuffle and reshuffle, meshing with radial teeth in the cone disk faces. Operation is similar to the lever-adjusted belt drive. In addition, there is a shoe and spring mechanism that presses on each side of the chain between the conical disks, to effect proper chain tension.

These advantages are claimed for the self-tooth-forming chain feature: (1) Power transmission is positive, non-slipping. (2) Unit is independent of friction for stepless speed changes. (3) Transmission is designed to maintain speed-control accuracy up to 0.25%, from no load to full load.

Multigroove transmission, Fig. 4, incorporates special variable multigroove sheaves mounted on parallel shafts. This unit employs several belts in parallel to transmit added power.

By a single movement of the handwheel, the pitch diameters of sheaves on both shafts are changed simultaneously through a worm gear. When one diameter increases, the other decreases, effecting a wide change in output shaft speed while unit is running. Operation is based on the principle of multiple V-belts running between positively actuated disks.

All enclosed variable-cone transmissions can be operated by remote or automatic as well as manual control. Mechanical, hydraulic, pneumatic or electronic controls can be used with equally good results.

To get best speed regulation, select the entire system carefully. Prime mover and variable transmission must be matched to the needs of the job. Ample capacity and range, which must be provided, will be discussed in a future article on applications.

1 Typical departmental meter board in an industrial plant. This installation facilitates keeping accurate records of the electrical consumption in key areas

2 Polyphase watt-hour meter with case removed to show the motive element

First Aid for Plant W-Hour Meters

Here is handy information for the man metering his plant's electrical use: fundamentals of watt-hour meters and practical trouble shooting for five common causes of inaccuracy

► BEFORE DIGGING into this matter of watt-hour-meter maintenance, let us get a few fundamentals under our belts. First of all, the polyphase watt-hour meter is a combination of the single-phase meter's elements, driving a shaft at speed proportional to total power. Meter consists of a multi-element motor, means for balancing the torques of all elements, a magnetic braking system, a register, and the necessary compensating rigs. All these components are put together in a meter frame.

Wattmeter measures basic unit of electrical power, the *watt*. Electrical power is the rate at which electrical energy is used. And this unit of measurement, the watt, implies a time factor. Hence, the term watt includes the implied meaning "per hour."

But when we think of watt-hour meters we are dealing with electrical *energy*. We can define that as the total use of electricity over a period of time. It is the product of rate of use (power or watts), multiplied by the number of time units, usually measured in hours.

Meter Operation. The instantaneous speed of the watt-hour meter's motor is proportional to the power passing through it. On top of that, total revolutions in a given time are proportional to total energy, or watt-hours, drawn during that time. Besides the motor, this meter has a magnetic braking system and a register.

Calibration. Now for a thumbnail sketch of calibration and adjustment. You have seen men from the local utility run checks on watt-hour meters in your plant. They use a standard indicating wattmeter to measure the average power over a stated period. And, at the same time, they count revolutions of the watt-hour-meter disk with the aid of a stop watch.

Then they check the average meter watts by taking the watt-hour-meter constant *K*, and multiplying it by the number of disk revolutions. This quantity is multiplied by 3600, and the product is divided by the time in seconds, ticked off on the stop watch. Value of watts they get through these mental gymnastics is compared with the watts read on the standard wattmeter. That constant *K*, mentioned above, is the number of watt-hours represented by a single revolution of the aluminum disk.

Meter is adjusted to read properly at full load and unity power factor simply by varying the position of retarding magnets. It is adjusted at light load by the light-load adjustment lever that you can readily spot once the glass disk is removed.

Keep in mind that the above facts are set down in a very general way. The actual job requires more specific information and a better knowledge of the meters. But plant men should give careful thought to the trouble-shooting side of the picture, since watt-hour meters are widely used to measure electrical energy generated or consumed in various parts of a plant.

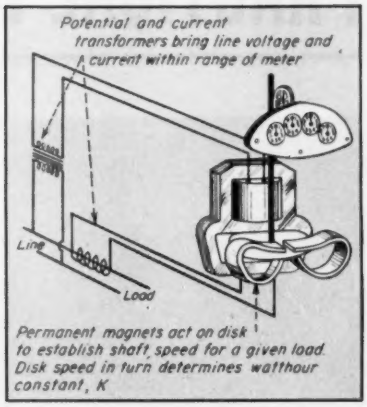
Trouble Shooting. The modern watt-hour meter is an inherently accurate and a stable device. When properly calibrated it retains its accuracy for a long time unless subject to influences outside normal operating conditions. So, in brief, the purpose of your maintenance of a trouble-shooting program is to (1) identify meters that have become inaccurate (2) find out what has caused the error (3) restore the meters to normal accuracy.

A watt-hour meter may be found inaccurate because of improper calibration or adjustment, incorrect installation, or the adverse effects of foreign influence.

Actually, when you boil it down there are few meters that are found inaccurate as a result of the first two causes. Possibility of mistakes from incorrect installation should not be ruled out when a maintenance check is being made, but outside influence is a much more common cause.

For instance, when the meter runs slow, the things to look for are: pos-

3 Testing boards like the one shown here are sometimes used to carry out meter trouble shooting. This method centralizes all checking and repairs in one area


Potential and current transformers bring line voltage and current within range of meter
Line
Load
Permanent magnets act on disk to establish shaft speed for a given load. Disk speed in turn determines watthour constant, K

4 Meter may be connected directly in a low-voltage, low-current circuit

sible dirt; a magnetic short; bearings that are dry, worn or out of line; shaft bent; gears too tight; shorted current coil; open potential coil; meter not level; incorrect adjustment.

On the other hand, if the meter runs fast, think in terms of a possible weakened braking magnet or incorrect adjustment. If meter runs backward, you have an incorrect connection.

A creeping meter may result from vibration, stray fields, excessive voltage, shorted current coils, incorrect adjustment, voltage leakage or ground in wiring.

Dust or Dirt. Dust, dirt or other foreign particles, like tiny pieces of metal, are the most common cause of incorrect operation after watt-hour meter has been in service. They may tend to close the air gap between the disk and the electromagnetic polepieces, and thus cause friction. This is especially likely if the dirt includes particles that cling magnetically to the magnet, and align themselves with the flux so they rub on the disk. Dirt in any of the gearing will increase gear loading, and may cause the meter to slow down. The answer is simple. Just give it a thorough cleaning.

Bearing Troubles. Worn or poorly aligned jewel-and-pivot or ball-type bearings increase value of the friction load, and thus make the meter run too slowly. Wear from this source is greater with light loads than with heavy, and becomes progressively greater as long as the worn bearings are left in service. Bearing friction may also be increased to an objectionable degree if the meter is out of level. Lack of lubrication of the pivot bearing is another source of increased bearing friction.

Misalignment or improper adjustment of bearings is generally an indication that the meter has been subjected to severe shock, either mechanical or electrical. Best solution is simply to replace the bearings. Of course, there may be cases where it is best to oil the pivot bearings or level a tilted meter. On the other hand, it may be best to have a repairman completely overhaul the meter.

Bent Shaft. When you come across a bent shaft or a warped disk, you invariably meet up with measurable errors in watt-hour-meter registration. A bent shaft or a warped disk generally indicates that the meter has been roughly handled or subjected to excessive surges. Your best bet is to return the meter to the shop for a thorough and complete overhaul.

Defective Coils. A shorted turn in a current coil of a watt-hour meter lowers the torque near or at full load. At light load, however, meter may run fast or slow depending on which of the two coils is shorted. A short circuit in the potential coils changes the meter's torque and also its lag adjustment. Shorted turns may indicate that surges have been applied to the meter. Once again, your best bet is to return the meter to a competent shop for an overhaul job.

Weak Magnet. A braking magnet, whose strength has been reduced by exposure to excessive stray fields or surges, allows the meter to run faster than it should. In this case, the answer is simply to replace the weakened magnet with a new one.

Creeping can mean a headache. By this term we mean a continuous, slow rotation of the disk when there is no load on the meter. The disk may creep either forward or backward. Although the creeping has to be rather fast to have any effect on meter registration, it is standard policy among meter-test men to permit no creeping of meters in service.

Watt-hour meters are intended for use where they are not subjected to vibration. And any unusual amount of vibration may cause creeping.

But if stray fields are strong enough to produce eddy currents in the meter disk, these currents may react with the potential coil flux to develop a torque that causes creeping. Once again, the only answer is to relocate the meter, or shield it magnetically so the stray fields will not affect it.

Or if the line voltage is considerably above normal, the compensating torque due to a light-load adjustment is proportionately higher, with the result that the meter may creep. The solution is simply to recalibrate the meter to operate at the higher voltage.

In short-circuited turns in the current coil, flux of the potential coils induces voltage. This causes eddy currents in the disk, and results in creeping. You will find it best to return the meter to the shop for complete overhaul and replacement of the defective coil.

Creeping may also be traced to improper connection. For example, when the meter is installed with potential coil connected on load side of the meter, creeping results.

Sometimes creeping is caused by leakage or grounds in the metered circuit. This false creep disappears when meter is tested with load wiring disconnected from meter. You can make a quick check on this by disconnecting meter and running a megohmmeter test on the load wiring.

PRACTICAL IDEAS...*here's the trading post for your*

Danger! Don't Do Like This Guy

NEVER USE compressed air to clean your clothes. This guy thinks he is using his head to blow dirt from his coveralls. But the practice is unsafe and highly dangerous.

Many people are injured every year from blowing dirt into their skin. Or dirt is blown into their eyes, with impact of a bullet, or into someone else's eyes. This method isn't safe, even when using goggles. So don't do it. You have only two eyes. Why not keep them?

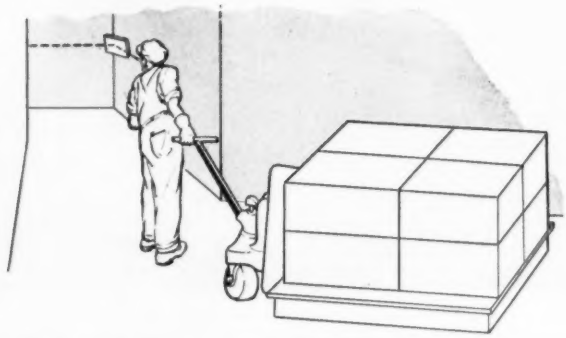
BILL DAVIS
National Safety Council, Chicago, Ill.

Save Time With Electrical Repair Kit

WE INSTALL one electrical repair kit, containing fuses, fuse puller, pliers, tape, flashlight, etc, on the shop walls of each floor. This saves much of the repair man's time by not having to go first to maintenance department office to pick up electrical parts and tools.

This handy repair kit enables repair man to get machinery running again with the least loss of time. We paint a large wooden or metal box having a hinged white cover and place a lock on it. Paint on cover says, "Emergency Electrical Repair Kit," in red letters.

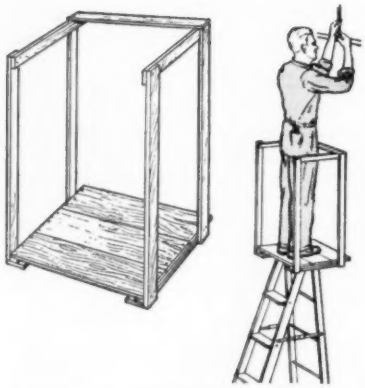
F LETTINO *Astoria, N. Y.*



Mirror Helps You See Around Corner

IN A STAIR WELL, or wherever aisles cross, there is always danger of people colliding with each other or with objects being pulled or carried in these blind spots. Simple way to avoid this trouble is to place mirrors at angle, sketch. That permits a "preview" of what is around the corner. In this case, a little "foresight" may save a great deal of damage or injury. All of our corners have them now.

S V WORTH *New York, N. Y.*

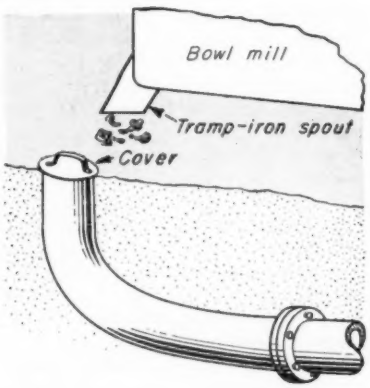


Platform for Stepladder

AT TIMES you have to work from top platform of a stepladder. But because of accident hazard, this is not good practice. Hazard results from not only narrow platform, but also insecurity felt by worker high up. We solved this with detachable platforms for our stepladders, sketch.

Detailed sketch shows platform made of one-inch lumber. Make platform floor slightly longer at one end so it rests on ladder while sliding on. Don't make floor more than twice narrow dimension of ladder platform. Make rail about waist high to average worker. One man can easily place platform in position. We find that no clamping or fastening is needed.

L KASPER *Philadelphia, Pa.*



Ash-Evactor Discharge

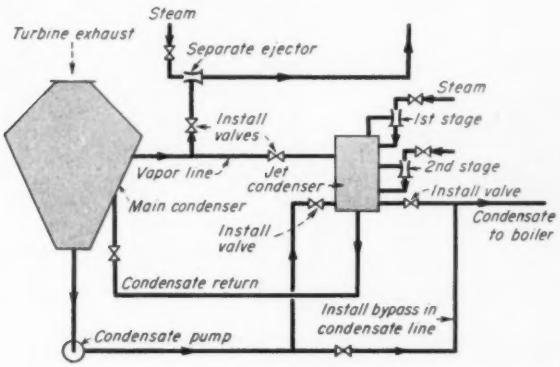
WHEN HANDLING large quantities of low-grade coals, discharge of small-rock and shale particles, thrown out by our bowl mills through tramp-iron spouts, was a problem. We collected this material in wheelbarrows, and wheeled it to an outside dump. From there it was later trucked away.

An underground pipe connection, sketch, from bowl-mill floor to boiler ash evactor (suction type) piping, solved this problem nicely. Now the mill discharge is allowed to collect in containers. Whenever ash is pulled, pipe covers are lifted and discharge poured into lines. Ash evactor discharges it to ash receiver, from which it's trucked away daily with ash.

J A SWANSOM *Princeton, B.C.*

operating and maintenance short cuts

STEVE ELONKA, *Associate Editor*



Vapor-Removal Jet-Ejector System

THIS HAS an additional feature that makes vacuum troubles less of a nuisance. Some of you may already have a similar setup. Most condensers have a set of first- and second-stage jet ejectors with condensers for condensing the steam supplied to the jets, or any steam that might be pulled from main condenser. There are many makes and arrangements of vapor-removal systems.

Some manufacturers build system into one compact unit of precooler, intercooler and aftercooler. Others build separate condensers for each section.

Whatever the design, it's built to do same job as all others. That is, to remove vapors from main condenser. But if your ejector system fails, vacuum is lost. Then turbine must be taken out of service until repairs are made.

Add to your system a single steam jet ejector, designed for vapor conditions of unit it serves. Install to take vapor out of same vapor line connected between main condenser and regular jet-ejector system you now have.

Steam in sketch is piped to single jet through a separate line from the regular jets. Discharge can be to atmosphere, or to condenser if condensate is to be saved. Addition of a condenser will increase installation cost. To use this separate jet individually, or regular jet system individually, install separate valves in vapor line to each, so either can be isolated without affecting operation.

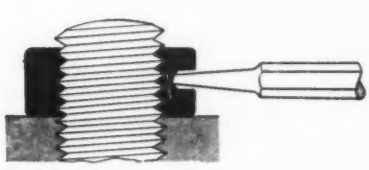
If there's a condensate return line from regular jet condenser to main condenser, install valve in this line so line can be blocked off when single jet addition is in service, or when regular jet ejectors are off. If condensate direct from condensate pump on unit is used as cooling water on regular jet condensers, install a bypass. Then you can bypass condensate around regular jet condensers when they are out of service, also when single jet system is in service.

By adding this one single jet, any overhaul job can be done to regular jet-ejector system without affecting operation. If your plant has several condensing units and you wish to save on the budget, buy a single jet to handle vapor from largest unit. Hook up so it can be used on any condensers as an emergency unit.

This can be done by individual vapor outlets from each unit with a separate valve on each. Then connect all into a common-line hookup to single-jet installation. Use separate steam supply that's not tied in with any other jet-supply lines.

D WHISENHAND *Houston, Texas*

Locking Nuts With Center Punch



DRILL a 1/8-in. hole in the side of a nut, not quite through to threads, sketch. Then screw the nut up tight. With prick punch, force in metal against threads as shown. That locks nut.

W E WARNER
Woodford Green, Eng.

Roller Puts All Paint On the Wire Fence

WHEN COATING wire fences by brush or spray, more material is wasted than ends up on fence. I tried using the roller shown, as suggested by the Rust-Oleum Corp.

This special, long-nap, lamb's-wool roller, thoroughly saturated with paint, does the trick. I dip roller into the 5-gal container, and roll it up the board to remove excess paint. By rolling it along the wire fence, and even along barbed wire, wire is completely coated when applied from both sides.

I find this painting method not only saves time, but job is not messy. And all the paint goes where it's supposed to —to protect the metal. Spraying this fence last time wasted paint.

JACK HATHAWAY *Canton, Ohio*

Broom Handle Does This Neat Trick

KEEP A SECTION of broom handle handy for those light bulbs that break off and leave the base in the socket. Rough up end of wood a little. You will then find it grips broken base enough to unscrew it from socket easily.

ED ECKERT *New York City*

(Continued on page 130)

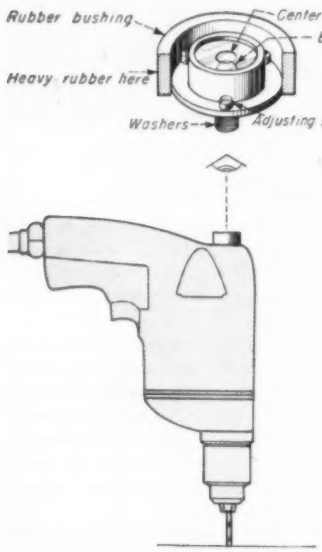
More PRACTICAL IDEAS

Begins on page 128

Old Tanks Make Sturdy Workshop

RATHER THAN SCRAP these outworn metal tanks, Southern Pacific Railroad Co converted them into a work shed and locker room, photo. Both are neat in appearance, fireproof, rainproof, sturdy and compact. Converting them cost much less than building new workshops.

G BURNLEY *Oakland, Calif.*



Circular Spirit Level Helps Drill Vertically

CIRCULAR SPIRIT LEVEL shows if surface is either dead level or tilted. It also shows direction of tilt without placing in various positions on surface. Level can be clamped to surface so bubble is in center of level as indicated by circle engraved on glass cover. Such levels are common on surveying and other instruments.

This level is very handy on portable power tools. Typical use is electric drill, sketch. Fasten level to drill handle as shown. Any deviation of tool from true vertical position shows at once.

Secure level to drill with three screws passing through level's flange. First, set level on irregular surface of drill's body-casting with washers under screws. Add thin paper washers under screw until spirit is level. While setting, mount a length of drill rod vertically with an accurate V-block placed on a level marking-out table. Grip drill chuck onto vertical drill rod, then adjust level by inserting washers until bubble is in center of target circle.

Level is sensitive to tilt, so any deviation from true vertical when drilling overhead or downward is magnified greatly. To protect level from accidental blows, surround it with a piece of heavy rubber hose clipped around level.

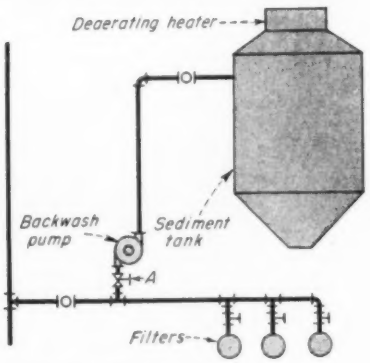
C T BOWER *London, England*

Solder and Gasoline to Lock Nuts

THREADS of screws and nuts can be locked with shellac. First paint threads with shellac. When it sets, threads will be locked together and connection cannot loosen without heating.

Objection is that joint is insulated. Also, heat can loosen and threads may break if forced. So don't use shellac; paint threads with a thin paste of gasoline and fine lead or soft solder.

W E WARNER *Woodford, Green, Eng.*



Converting This Hot-Process Softener

YEARS AGO we installed a hot-process water softener, for pretreating our boiler feedwater. Results over the years have been highly satisfactory. Main reasons are that we had water of practically zero hardness, with almost no dissolved oxygen present.

Recently the dissolved oxygen content started rising, and we couldn't maintain the right operating temperatures on the softener. There seemed to be no indication of what was causing these conditions. We started to worry when the oxygen content reached a value of 1.02 parts per million.

It seems when the softener was originally installed, provision was made to backwash the water filters with clean fresh water from the mains of the local water company. This worked very well until we installed a backwash pump, using water direct from sedimentation tank for backwashing, pumping through filter bed and back into sedimentation tank.

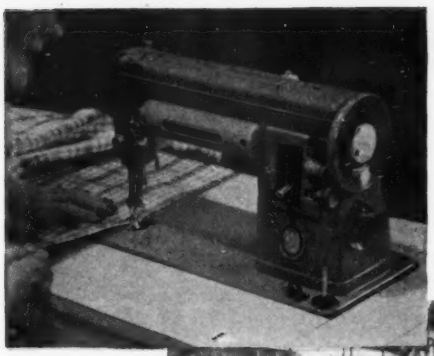
While this system operated all right, we were not entirely satisfied with results. So we returned to original method of backwashing as used at first. Then valve marked *A* on the sketch above was shut, and pump wasn't used.

Recently we discovered that the casing of backwash pump was very cold, which was caused by valve *A* leaking. This allowed cold service water to enter below the deaerating heater. Cold water entering at this point lowered water's temperature in softener and allowed oxygen-laden water to enter also. Valve *A* was removed and a new valve installed.

Then upon checking the softened water after this change, we found we had lowered the dissolved-oxygen content to 0.02 parts per million, and operating temperatures returned to normal.

E SMITH *Clark's Summit, Pa.*

(*Continued on page* 132)

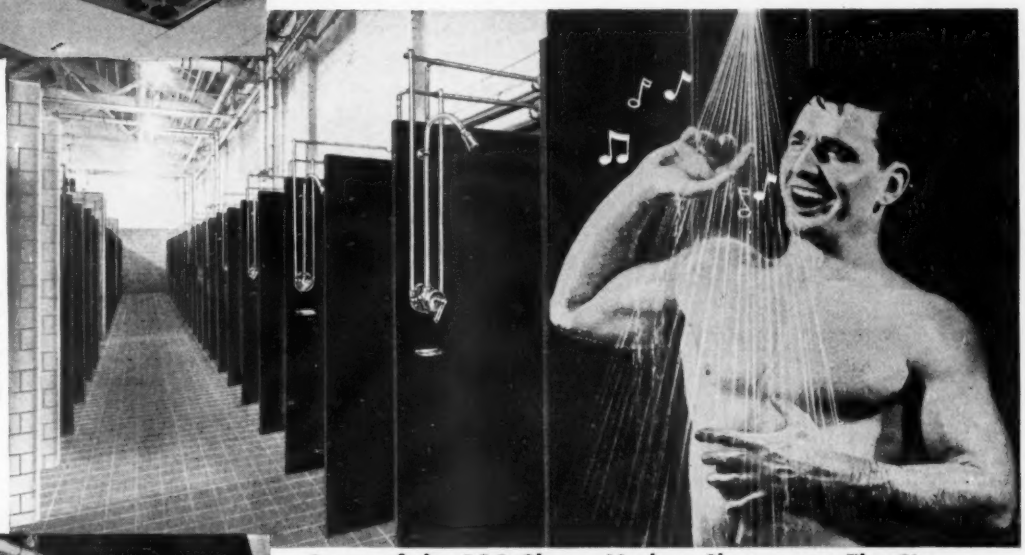


Workers Sing in the Showers
Regulated by POWERS
at The SINGER MANUFACTURING CO.
Plant in Elizabethport, New Jersey

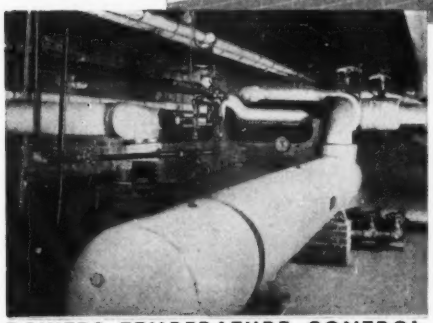
Above:
A magnificient new model in the already world-famous line of SINGER Sewing Machines

•

Right:
One of Singer's Shower rooms has 98 showers, another 58 and there are several smaller ones for individual groups.



Some of the 190 Clean, Modern Showers at The Singer Mfg. Co. Each shower is individually controlled by a



POWERS TEMPERATURE CONTROL on HOT WATER GENERATORS

serving the various shower rooms is shown above. For this type of service a Powers ACCRITEM Regulator and FLOWRITE Valve are often used.

When You Have Problems of Water Temperature Control contact Powers nearest office. With over 60 years experience and a most complete line of controls we are well qualified to help you.

Mixer for Exposed Piping

POWERS

Thermostatic WATER MIXER

The Best Showers that money can buy — is only one of the many reasons why employees remain almost twice as long with SINGER as the national average.

Mr. F. H. Gummick, Plant Engineer for this famous 100 year old firm, says "The Singer Mfg. Co. has provided employees with the best shower room equipment obtainable. We consider it an investment in good employee relations."

Powers Temperature regulators on each individual shower as well as on the hot water generators serving the showers is the best insurance for a SAFE, COMFORTABLE shower.

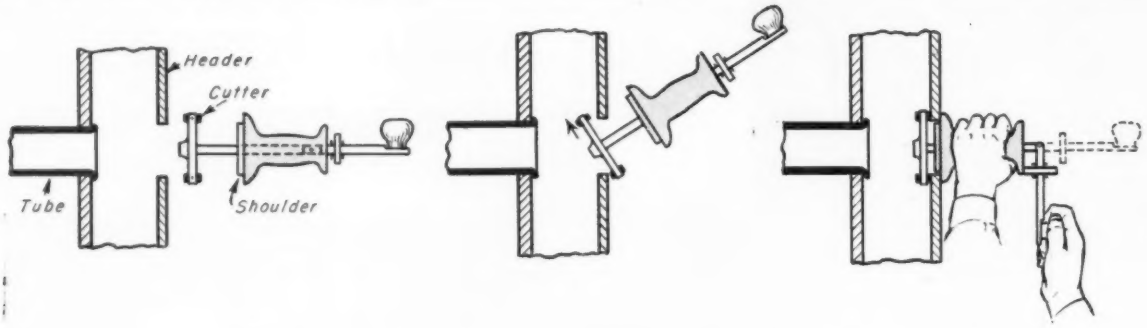
No Unexpected "Shots" of icy cold or scalding water here. Powers *thermostatic* water mixers always keep the water temperature just right — regardless of **pressure** or **temperature** changes in water supply lines. Write for catalog Rb24.

(b14) • *Only ONE Shower Accident Can Cost Many Times More Than POWERS Water Mixers* •

Established in 1891 • THE POWERS REGULATOR COMPANY • SKOKIE, ILL. • Offices in Over 50 Cities

More PRACTICAL IDEAS

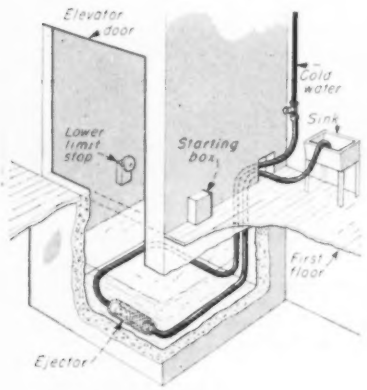
Begins on page 128



Reseater Cuts Down Handhole-Plate Leakage

WHEN YOU HAVE 1078 handhole covers on one boiler, they can be a headache. Our vertical-tube header has 569, front header 509. Refacing cover seats with reseater shown saves a lot of trouble. Tool, bought from equipment manufacturer, has been worth its weight in gold. Get tool with cutters set at right distance for your handhole-plate gasket surface inside header. Also, with right size boss on handle to fit tube hole.

D WHISENNAND *Houston, Tex.*



Now Ejector Moves Water Without Boiling

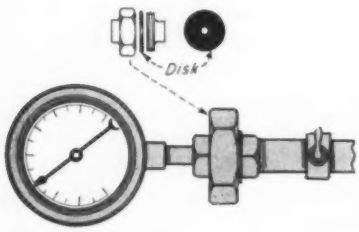
MANAGER of a New York City building asked me to come in early each morning. He showed me a water spring in pit of sidewalk hoist. Every morning, four or five porters and waiters spent several hours bailing pit with pails.

Down-limit-switch was very low on hoist wall in pit and out of commission whenever water reached switch. First, I moved switch up above water level.

Manager wouldn't have pit waterproofed because he said it was an expensive job. So I rigged up water ejector I bought at hardware store. I installed a faucet in cold-water line near by, sketch. Then I ran a hose from ejector pit, connected it to inlet end of ejector and hooked another hose from discharge into nearby sink. Ejector was placed on pit floor. Then I enclosed it with fine woven-mesh copper wire so it wouldn't clog.

Hose was placed in pit where it didn't interfere with hoist operation. With water turned on, ejector worked swell. Pit was emptied in less time than it took the pail gang to do it, and cost little.

J W BLAKE *New York, N. Y.*

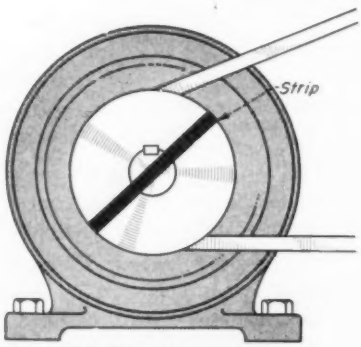


"Snubber" for Pulsating Gage

WHERE A PRESSURE GAGE is used on a fluctuating supply, it's often hard to keep it in shape because of intermittent shock.

A "snubber" can be made from an ordinary face-to-face union with a small plate between the halves, sketch. Make small "pin hole" in the center of disk. Then a petcock or needle valve will give adjustment enough if needed.

T HOLLORAN *Toronto, Canada*



Find Motor Speed With Fluorescent Lamp

IT'S EASY to find speed of squirrel-cage induction motor, if an observer can see end of shaft.

Make a stripe, with chalk or paint, on wheel or shaft, sketch. Light motor with a single fluorescent bulb. Remove all bulbs but one from fixture. When motor runs, "spokes" will be seen revolving slowly in opposite direction from the motor's true rotation.

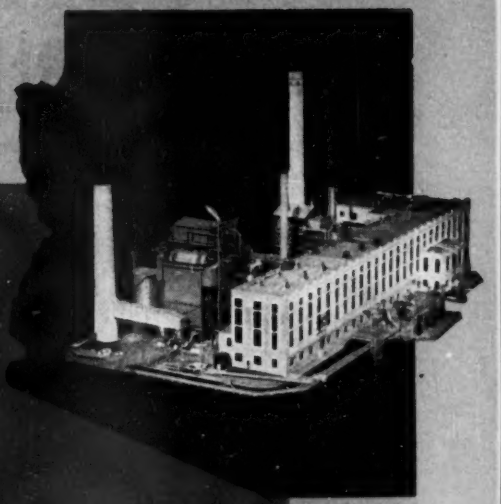
Count number of times a spoke revolves in one minute. Call this number the "slip rpm." Then speed of motor equals its synchronous speed, minus the slip rpm.

Suppose motor nameplate reads, 5 hp, 1750 rpm. Synchronous speed of this motor is 1800 rpm, and the speed with 5-hp load is 1750 rpm if voltage and frequency are right. Now suppose we test this motor as above, and find slip rpm to be 25. Then motor speed at time of test was 1775 rpm, and motor had about half load, or 2½ hp (since motor had half its full-load slip rpm).

Any watch good enough to tell time of day is accurate enough for this test. Chances are you won't find the slip rpm and the motor speed correct to 1 rpm. I also calibrate a tachometer so.

A HOLT *Miami, Fla.*

ALSO IN ARIZONA, IT'S YARWAY



PUBLIC SERVICE

PICKS

YARWAY UNIT TANDEMS

FOR 920 PSI BLOW-DOWN SERVICE

Arizona Public Service Company—operating in the youngest, but one of our fastest-growing states—is another prominent utility that relies on Yarway Unit Tandem Blow-Off Valves to guard its boilers. In fact, *4 out of every 5 high pressure boiler plants are Yarway-equipped.*

Such popularity had to be won. It was—by offering good design, careful engineering and manufacturing, modern metallurgy and dependable service.

Yarway engineers, conveniently located near you, are constantly working for better, more profitable steam plant operation. Need help? Call a Yarway man.

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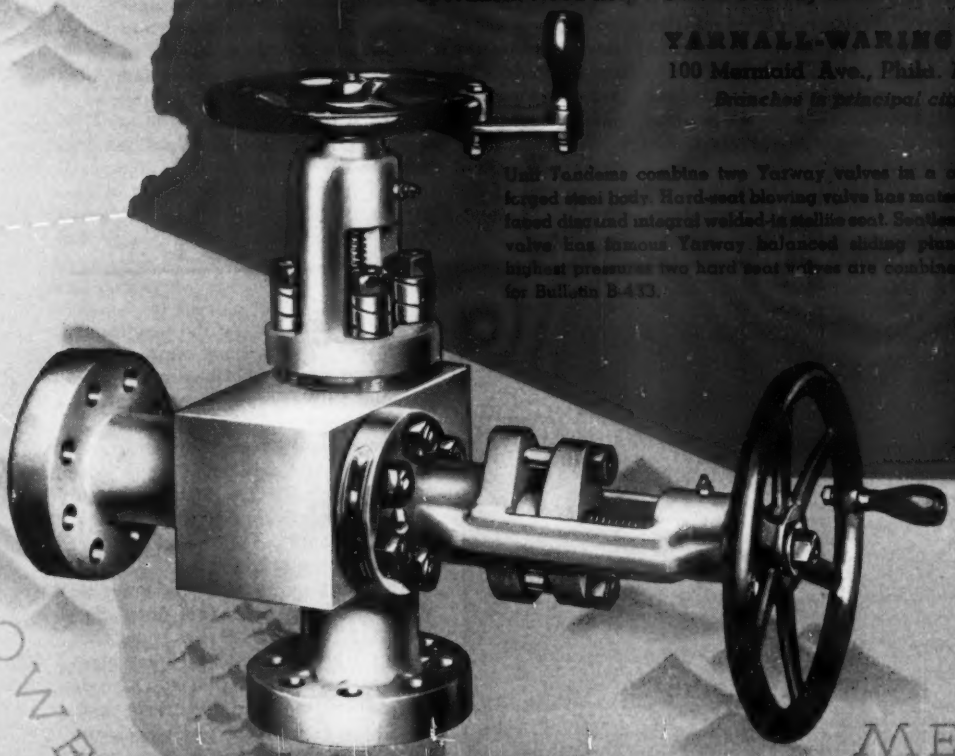
Unit Tandems combine two Yarway valves in a one-piece forged steel body. Hard-seat blowing valve has mated stellite-faced disc and integral welded-in stellite seat. Seatless cooling valve has famous Yarway balanced sliding plunger. For highest pressures two hard seat valves are combined. Write for Bulletin B-413.



YARWAY SERVICE GOES ALL THE WAY . . .

PLANT PROBLEMS... *put your know-how to work*

OUTDOOR VALVE markers give compass bearing and distance so personnel can easily locate valve. Sign also identifies valve

Question No. 1: How Can We Find Underground Valves?

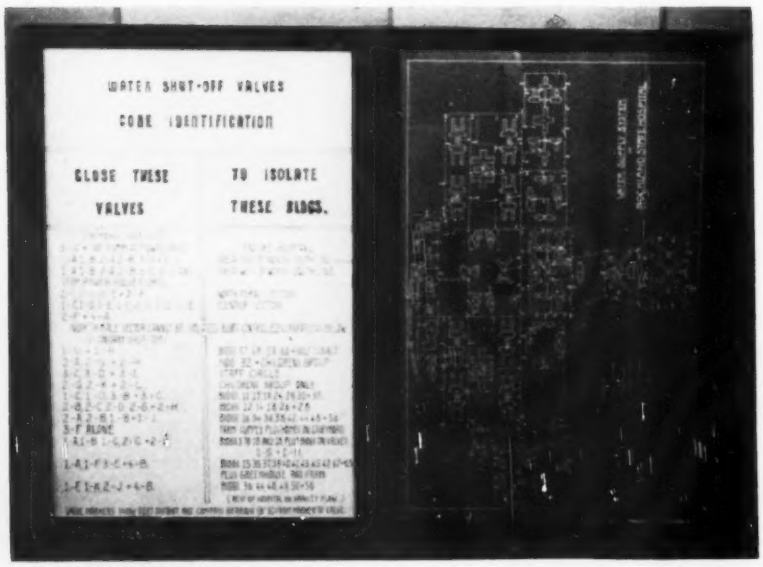
HERE ARE THE FACTS: Our hospital has over 100 buildings on 1600 acres. Water-supply pipes run underground to all parts of hospital. System is quite complex.

Several times we've had to find underground shutoff valves in a hurry. Because we have no positive system, we've wasted water, isolated the wrong buildings, and had other delays.

Problem is further complicated by system changes not shown on our plans, personnel turnover, and poor indication of valve location. I'd like to straighten out this mess without having to dig up every pipe and valve we have, then place unobtrusive markers for the valves that won't interfere with lawn mowing.

What's best way to mark valves? How can we find them?—*BL. April Power*

Here Are the Answers



CODE IDENTIFICATION of water valves and piping-system plan simplify valve use

OUR HOSPITAL, a mental institution, resembles *BL's* in many ways. A few years ago we had the same problem of locating valves in water-supply mains. Here's how we solved it.

Several emergencies showed few of our men could locate the right valve in a hurry. We lost water, suffered building and equipment damage that would not have occurred if the correct valve had been closed.

To set up our marking program we divided our land into plots called Sectors 1, 2, 3 and 4. Sector boundaries were marked on two large plot plans of the water-system piping. A code designation was assigned each main shutoff in each sector and marked on the plan. Code consists of sector number and a letter for each valve. For instance, 2-C indicates valve C in sector 2.

Next, we drove a stake near each valve. Then we placed a compass on top of the stake, and stretched a string

help the other guy cure his headaches

TYLER HICKS, *Associate Editor*

between it and a point over the center of the valve. Bearing of the string was noted, and distance between valve and stake measured. Code designation, valve bearing and distance are stenciled on a marker attached to stake. Photos, top of facing page, show several typical stakes with their markers.

Before placing stakes we considered three items: (1) accident hazard to pedestrians and traffic (2) operation of power lawn mowers and other gardening equipment (3) danger to patients, or removal of stakes by them. Study showed best location of stakes was usually near permanent objects—buildings, trees, fences, etc. Distance of stake from valve was not too important.

Stakes are made from scrap 1-in. pipe, having a 4-in.-square scrap steel plate welded to bottom. A 5x8-in. marker plate is welded to stake top. Post-hole digger is used to place the stakes. Backfill is well tamped in. Stakes cannot be removed without digging up earth around them. Height of stakes varies with snowfall conditions. Ours are 24 in. above ground.

Our last step was to make charts showing valve use, and which ones must be closed to isolate a building. Charts are hung beside plot plan in plumber's shop and engine room, photo, bottom, facing page. Valve identification is easy.

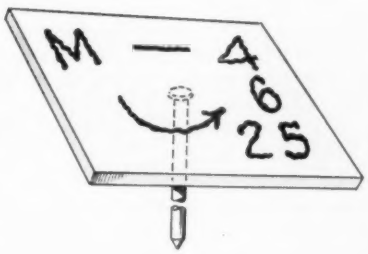
In an emergency all we need know is building or area affected before referring to chart to see which valves we must close. Equipped with a compass and measuring tape the operator easily and quickly locates the valves on his first try.

What we like about our system is that even though men come and go, and valve locations may be changed, a new man can always find the right valve. Of course, this assumes markers will be changed whenever valves are. But to date this job hasn't proven burdensome because valves are so seldom changed.

Markers are used only for main shutoffs. Valves for hydrants, buildings, sprinklers, etc, run into the hundreds and individual identification would be confusing. In an emergency we isolate a whole area: then when we have more time, we return to shut the smaller valves.

We think our system is tops. The idea is not new, but this use of bearings in degrees instead of letter points eliminates confusion, especially where three or more valves are in a 5-ft circle and some distance from the markers.

L C VAN HUBEN *Orangeburg, N. Y.*



LOCATE VALVES that are "lost" under ground by moving a large compass over the area where valve is thought to be. By keeping card vertical, the needle assumes a vertical position when directly over valve. An army mine detector might also be used, but I haven't yet seen one tried.

Make markers from flat $\frac{3}{8}$-in.-thick steel plate about 6x8 in. Weld a 2-ft length of scrap pipe or rod to plate bottom. Letter plate with raised beads of weld metal on top face. Paint a bright color, such as yellow, to contrast with lawn. Drive plate flush with grass so lawn mower clears it.

Identify main and branch water lines with a letter corresponding to that on blueprint of system. Use numbers for further identification and an arrow to show direction valve is opened, sketch.

Bring blueprints and records up to date as soon as possible after locating valves and manholes in piping system.

A W GOULD *Lowell, Mass.*

USE MINE DETECTOR, purchased in a surplus-material store. It is simple to operate and can be carried by one man, as the sketch above shows.

A M PALMER *Brooklyn, N. Y.*

IN ERITREA, Africa, in 1942, we ran into almost the same problem when building an aircraft repair base on the site of the Caproni assembly plant, which had been severely bombed. By interviewing prisoners of war we found a man, Angelo, who was willing to work for us and who knew the water system.

Starting from scratch with the lines we could find and Angelo's memory, we approximated the valve positions, marked them with stakes and started digging. Sometimes we found a manhole or a valve after much digging. If we didn't, we installed new valves. By cut and try we found the areas controlled by each valve, recorded them, and stamped this information on brass handwheel disks.

After building manholes for the valves, we stenciled reference markers on the nearest permanent structure. Besides making drawings of the layout we prepared a listing that quickly directed a person to any valve he was interested in. Total time for job was about 60 days, but we saved its cost the first year. Sketch above shows typical reference marker used on this job.

HOWARD HOLCOMBE *Los Alamos, N. M.*

SEVERAL SCHEMES *BL* can use are:

1. Unless accurate drawings of piping system are available, prepare a flow diagram showing equipment served, pipe sizes and valve tag numbers. Be sure to include master shutoff valves that isolate a building.

2. Identify all pipes by stenciling service name on pipe where it is readily seen. Or use color bands recommended by American Standards Association.

3. Attach metal tags to valve handwheels. Secure with handwheel nut or clamp on wheel spokes. List service,

For this month's two new questions, turn to page 138

More PLANT PROBLEMS

Begins on page 134

pressure and temperature of system on valve tag. Number on tag should correspond to that for valve on the drawings.

4. Temporary valve pits may be made of wood with a metal cover. Permanent valve pits or manholes are best made of concrete because they have a longer life and need less maintenance.

H B WAYNE *Brooklyn, N. Y.*

MY ADVICE to *BL* is to start by making a simple line diagram of his external water system. Show on this diagram all information concerning the system, including recent changes workmen may remember accurately. Men who dig a ditch and handle heavy pipes and valves usually have an excellent idea of just where the work occurred.

Use metal detectors to find where takeoffs leave the main line, and the route of unknown pipes. Secure a 1-in. earth auger driven by a ½- or ⅝-in. electric drill. Drive auger into ground when detector shows metal whose purpose is unknown. Lower a small light into hole to determine metal shape.

Compressed-air line can be used to clean hole, if necessary. Use a sharpened steel rod to probe for shallow pipes. Cracks in ground or a difference in texture often show where a ditch has been dug.

Use a 4x4-in. piece of floorplate or a nonferrous plate to mark valve location. Fit it with two legs to prevent it turning. Mount flush with ground in summer, raise it above usual snow level in winter. Mark valve-identifying data on plate surface.

D L COCHRANE *Milaca, Minn.*

START FROM WATER METER, tracing out lines with a mine detector. Make a drawing of pipes as you proceed. Locate each valve with respect to some permanent landmark.

Hang pipe drawing in maintenance office so all new employes can become familiar with it. We have a drawing like this in my plant and it has always been a big help.

ERNEST SIDEWITZ *Brooklyn, N. Y.*

INSTALL NEW VALVES in lines when they are located. This saves digging cost and allows positive identification of valves. Revise piping drawings and operating instructions to include these new valves.

Use metal, concrete or wooden pits to protect underground valves. Pour crushed stone into pit bottom to permit good drainage. Allow surrounding grass to grow over pit cover, if desired.

A J BREUGELMANS *New York, N. Y.*

TRY TO BORROW a pipe-locating device from your local water department or a nearby large company. Use it to trace out piping system, making a simple line diagram as you proceed. Assign numbers to valves and fit with post indicators to show if they are open or closed. *BL* can use extension valve boxes so lawn mowing will be easy.

G E BOYHAN *New York, N. Y.*

BEST PLAN is to have all main shutoff valves in basement of building they serve. Then you have no worries about snow covering them in winter or corrosion from rain and moisture.

A A HUNNEWINKEL *Woodstock, Ill.*

GROUND-LEVEL MARKERS of aluminum are good. *BL* should try a few and see. Fit markers with an opening for the valve stem. Have markings large enough so they are easily read. Aluminum markers are good above ground, too.

C G HOWARTER *Canton, Ill.*

Question No. 2: How Can We Stop These Valve Leaks?

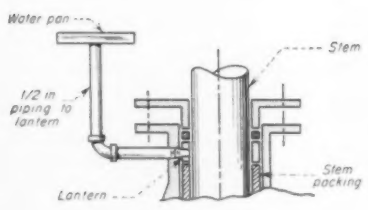
HERE ARE THE FACTS: Valves in lines to our two low-pressure feedwater heaters leak when the load is low. These valves are in vent, steam and drain lines for the heaters.

Plant is rated at 400,000 kw. Air appears to leak through valve packing at the gland. There's some leakage at stem, too.

New packing doesn't help much. Air that leaks through the valves shows up in our condensers, hurts plant performance.

Since most of these valves are fully open or fully closed, we've been wondering if reversing them in the line would help. Flow would act on top of globe-valve disk, instead of bottom. Condensate on disk top would help seal valve while it is closed. Or is there a better seal?—*GD, April Power*

Here Are the Answers



ATMOSPHERIC PRESSURE, being higher than heater and condenser pressure, causes air leakage into the system. Use valves with lantern rings in bonnet to stop leakage. Supply clean water (condensate or boiler feed) to rings. Sketch shows a pan arrangement for feeding water to lantern ring.

GD may fit rings to valves himself or have valve manufacturer do the job. If only a few small valves are needed, it may be cheaper to replace existing with new ones made especially for this service. Results are better.

H B WAYNE *Brooklyn, N. Y.*

(*Continued on page* 138)

For this month's two new questions from Power readers, turn to page 138

NEW SOLNUS OILS GIVE YOU MORE LUBRICATION PER DOLLAR

New Multimillion-Dollar Plant Producing Better General Lubricants at Moderate Prices

They can be used for lubrication of plain bearings, antifriction bearings, linkages, slides, cams and gears; in gear boxes, hydraulic systems, circulating systems, industrial diesel engines, compressors.

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They can be applied by every method used in the general lubrication of industrial machinery.

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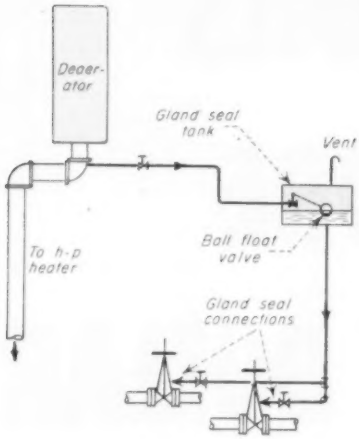
More PLANT PROBLEMS

Begins on page 134



PRESSURE ON TOP of the glove-valve disk would flood valve-stem packing and prevent leakage while valve is closed, as *GD* states. But with valve open and a low pressure in the line, a "venturi" condition might be set up, causing air to be sucked into the system through valve-stem packing gland.

A far better way to prevent leakage is to use a gland sealing system. Pipe water under pressure to the gland of every valve, no matter what its type, that is in a line to the condenser. Use a perforated collar to divide the stem packing into two parts, and pipe water to collar. Sketch shows a typical piping diagram for this setup.

Have enough head on each valve so there will always be a positive pressure on it. Then *GD* will be able to keep air out of the lines. Any leakage will be water, either into condenser or along valve stem to atmosphere.

Most large valves have bosses in the proper location for drilling and tapping. A ¼-in. tap is generally used. Some valves are supplied, drilled and tapped with the connection plugged.

Gravity tank provides a good pressure source. Have tank at a sufficient distance above valves to provide pressure needed. Air will not leak into the valves when there is a slight flow of condensate out through valve-stem packing gland. Trouble should disappear.

A M Palmer *Brooklyn, N. Y.*

VALVES with shallow stuffing boxes are not suitable for this service. Instead, use valves having deep stuffing boxes and fitted with a back seat that isolates packing chamber from line pressure. Since *GD* does not use these for throttling service, gate valves seem the best bet for his job.

Art Cannon *Laurence Harbor, N. J.*

SUPPLY CONDENSATE to valve stuffing box. Be sure to shut off sealing water when heater pressure goes above atmospheric pressure.

R A Pontefract *Chelmsford, Mass.*

REVERSING THE VALVES would not cure this trouble, in my opinion. *GD's* main trouble may come from plant heat balance. Check temperature, water level, and heater pressure during load changes. Do the same for condensate storage tank. You may find gas from system increases condenser pressure.

C G Howarter *Canton, Ill.*

THIS TROUBLE is caused by a basic design error and should be corrected as soon as possible so fuel won't be wasted.

Best cure is valves made especially for this service, or sealing of packing gland with condensate. Since only a few valves are involved, *GD* will probably be better off getting new ones.

Ira Kendall *New York, N. Y.*

YOUR NEW PROBLEMS FOR JULY

1 How Can I Regulate Water Pressure?

Our process work requires a water pressure of 30 to 31 psi. We have no elevated tank or pressure source other than a double-suction centrifugal pump that takes water from a tank mounted on plant floor.

When direct-connected to a 1000-rpm motor the pump discharges at 19 psi. Connecting it to a 1600-rpm motor gave a discharge pressure of 35 psi, which is too high.

We've tried throttling the pump discharge valve but this often reduces quantity below what we need. Storage tank can't be raised.

What's best way to control this pressure? Suction line runs level from tank into pump suction, the distance between pump and tank being about 2 ft. Discharge line runs horizontally to process units. Neither pipe has any pitch at all.—*DN*

2 How Can We Stop Boiler Vibration?

We generate steam in four stirling-type chain-grate stoker-fired boilers. Each is rated at 15,000 lb per hr. They have identical arch and furnace construction. One stack and a single breeching serve all boilers.

Three of the boilers run well at all times; the fourth often vibrates severely. It is fired with the same fuel as the others, and its stoker receives the same care.

We've checked stack damper for play, baffles for leakage, made CO_2 analyses in each pass, and looked into the possibility of secondary combustion.

Only way we can stop vibration now is to cut draft entirely, then reopen it slowly, hoping for the best. Boiler may vibrate off and on all day, then stop for weeks.

What's the cause? How can we cure the vibration? We're afraid it may be dangerous, and would like to stop it as soon as possible. What's our best solution for this problem?—*HS*

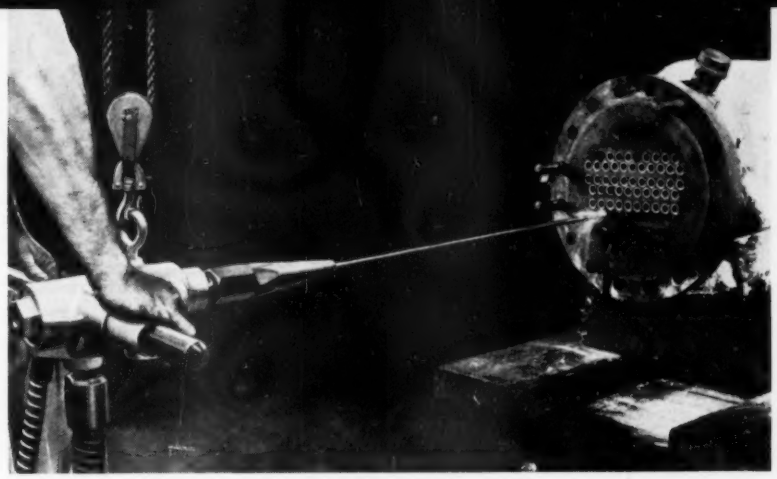
Don't miss next month's two problems.

Another chance to use your ingenuity

Will you help readers who sent us problems? Extra pay for photos or sketches.

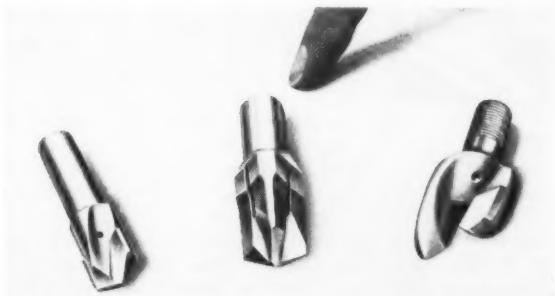
HOW TO

Clean Heat-Exchanger Tubes

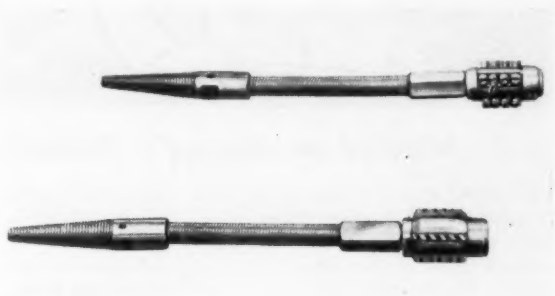


Courtesy, Thomas C Wilson, Inc

PLUGGED tubes in heat exchanger are 11 ft long, 1¼ in. OD. Here chips and scavenging water work backward from plugged tubes; otherwise, they are washed forward



CUTTING BITS are "business end" of cleaner. These are carbide for tough use. Experience tells which to use for job



EXPANDING cleaner or brush takes out residual deposits after cleaning. Flexible shaft connects them to the rotating cutter

► CLEANING fouled tubes mechanically is old—but there are many new tools you should know about. With more heat exchangers for process, fouled tubes often stop production. Cleaners shown are on-the-spot tools.

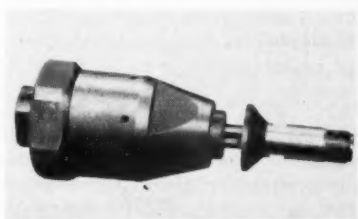
Problem is not drilling tubes, but removing debris, chips and other fouling matter from deep holes. Tools shown are air-driven, rotating at high speed. Scavenger air or water flows through unit, through hollow rotating shaft, and out through holes in cutter bits. That washes out "chips".

Speed is 3500 rpm, using 130 cfm at 90 psi or less. Tools are used for horizontal or vertical jobs.

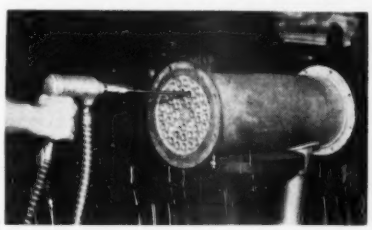
Operators often ask about "sagging" tubes. Hollow rotating shafts (some up to 40 ft long) have enough give to follow sags. Or operators run into deposits that may be hard and brittle in one section of tube, gummy or powdery in another.

But grip speed-control takes care of all conditions when used with good judgment. Control is handy when working in awkward position—handy for boiler air-preheaters, gas coolers, evaporators, fuel oil heaters, many others.

LONG SHAFT may whip while revolving. Use short pipe or rubber as shown here



VIBRATOR strikes 1900 blows per min to push cutter through tough deposits



LIGHT cleaner (3 lb), for small units up to 5 ft long, is handy around any plant

TROLLEY suspended overhead speeds work on long tubes, lifting cleaner's weight

ARGUMENTS

Here's the place to unload you.' gripes to editors, manufacturers and fellow engineers

Nibbles on Marmy's 'Knibbling Pin'

JUST WHAT is this "knibbling pin" that Marmaduke tells about (POWER, January, p 142)? No one in our plant seems to know the answer.

H W HOLCOMBE
Los Alamos, N. M.

EDITOR'S NOTE: *When we checked this query with Marmy, he blasted: "Even a knucklehead can find out what a knibbling pin is—just look in the dictionary, and make damn sure that you're careful to pronounce the K!"*

NOW aren't they known as nibbling pins?

(For Arguments we're striving!)
I think perhaps "ka-nibble" wins:
As in the word "conniving."

C ANKERS *Yonkers, N. Y.*

I'M WILLING to bet a bottle of Sandpaper Gin that Marmy will be in the Navy a long time before he ever tells us what a knibbling pin is!

GEORGE BURKE *Philadelphia, Pa.*

YOU EDITORS must really be naive to ask Marmaduke, "What is a knibbling pin" (POWER, April, p 144).

Before becoming landlocked in Minnesota I carried a knibbling pin with me on the old 502's in round-the-world service and on 535's in the Pacific run.

In fact, I've seen knibbling pins in most any establishment from Sauciehall Street in Glasgow to the Tan Jon Pagar in Singapore.

But before you can really appreciate one you must have come the long way via Slivowitz, Tuborg, Aquavit, Pisco.

S H KRONE *Canby, Minn.*

Readers Explain Meaning of 'Critical Pressure'

LET ME EXPLAIN why steam cannot form above critical pressure of 3206 psi (POWER, Apr, p 138):

At the critical pressure, surface energy (energy per unit area) equals zero. Heat of vaporization and surface tension also equal zero. Ordinarily, evaporation takes place when a molecule of liquid has enough energy to escape through the liquid surface. If temperature is sufficiently high, kinetic energies of translation of the molecules exceed the maximum attraction between them. A liquid state is then impossible.

Forces of attraction and repulsion are equal at the critical temperature. Pressure existing at this temperature is the critical pressure. Above critical temperature the liquid state is impossible for a single component, and increasing pressure only compresses the vapor, which retains all the properties characteristic of the gaseous state.

H B WAYNE *Brooklyn, N. Y.*

HERE ARE several reasons why steam can't form above 3206 psi, in answer to Kuchinsky's request in April.

(1) Highest vapor pressure that water can exert is its critical pressure. (2) Boiling cannot occur above 3206 psi. (3) There is no change in enthalpy between liquid and vapor phases, hence no latent heat of vaporization above 3206 psi. (4) Increasing pressure at saturation temperature decreases the difference in density between steam and water until the water level disappears. (5) Above the critical pressure, the substance is merely referred to as "fluid." There is no distinction between liquid and vapor phases.

J L COWAN *Solvay, N. Y.*

IN ANSWER to the question about critical steam pressure, consider the usual procedure for bringing up steam in a boiler. Water is heated with no gain in pressure until it reaches saturation temperature. More heat increases pressure and temperature along the saturation line, up to the critical temperature. Above this point, liquid phase cannot exist regardless of pressure; 3206 psi is corresponding pressure at the critical temperature.

Instead of bringing up steam in the usual manner, you might fill the boiler, close the vents, and pump up pressure higher than the critical point. Upon heating this high-pressure water to critical temperature, you note an interesting phenomenon. The water suddenly changes to steam, and no amount of compression can condense the vapor.

In passing, I would like to inquire whether this type of knowledge, or lack of it, really has any effect on normal plant operating efficiency?

H HOLCOMBE *Los Alamos, N. M.*

REGARDING Kuchinsky's question about why steam can't form above 3206 psi, here are reasons I would give:

Without a water or liquid state in the boiler there is no free surface from which steam can be vaporized because there is no latent heat of vaporization. Above 3206 psi, the only change that additional heat or firing can make is to increase pressure and temperature.

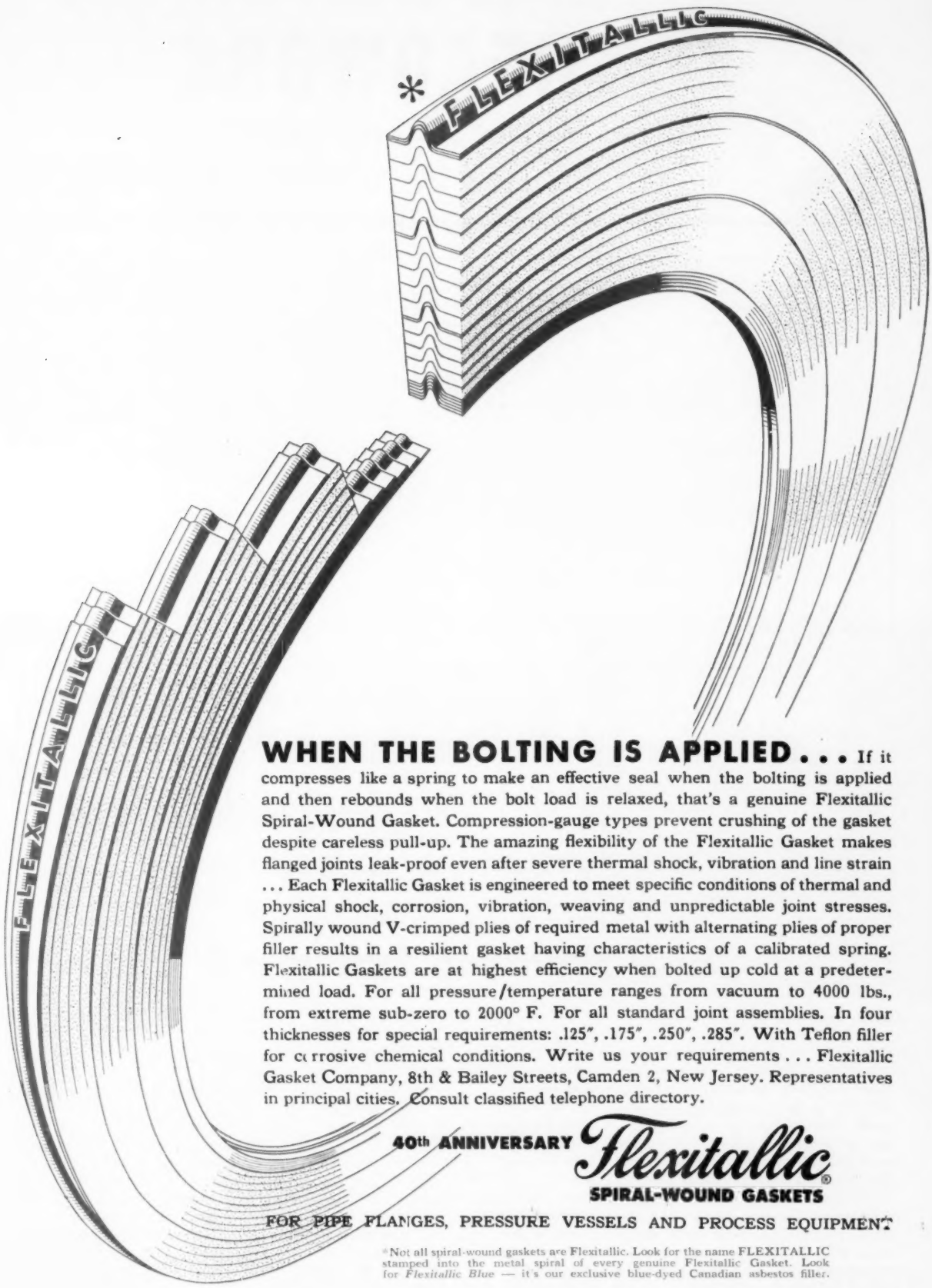
A BELTON *Montreal, P. Q.*

Thermometer Test

METHOD T Trail suggests for checking thermometers (POWER, Feb, p 129) is all very well if the water is relatively pure and elevation is not enough above sea level to affect boiling point.

For example, on the upper floors of Empire State Building, in New York City, water open to the atmosphere boils at approximately 210 F. Cook a piece of meat in it, and the temperature drops. Throw in a handful of salt, and up it goes, above the 212 F mark.

ART CANNON
Laurence Harbor, N. J.



WHEN THE BOLTING IS APPLIED . . . If it compresses like a spring to make an effective seal when the bolting is applied and then rebounds when the bolt load is relaxed, that's a genuine Flexitallic Spiral-Wound Gasket. Compression-gauge types prevent crushing of the gasket despite careless pull-up. The amazing flexibility of the Flexitallic Gasket makes flanged joints leak-proof even after severe thermal shock, vibration and line strain . . . Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-crimped plies of required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 4000 lbs., from extreme sub-zero to 2000° F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". With Teflon filler for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Company, 8th & Bailey Streets, Camden 2, New Jersey. Representatives in principal cities. Consult classified telephone directory.

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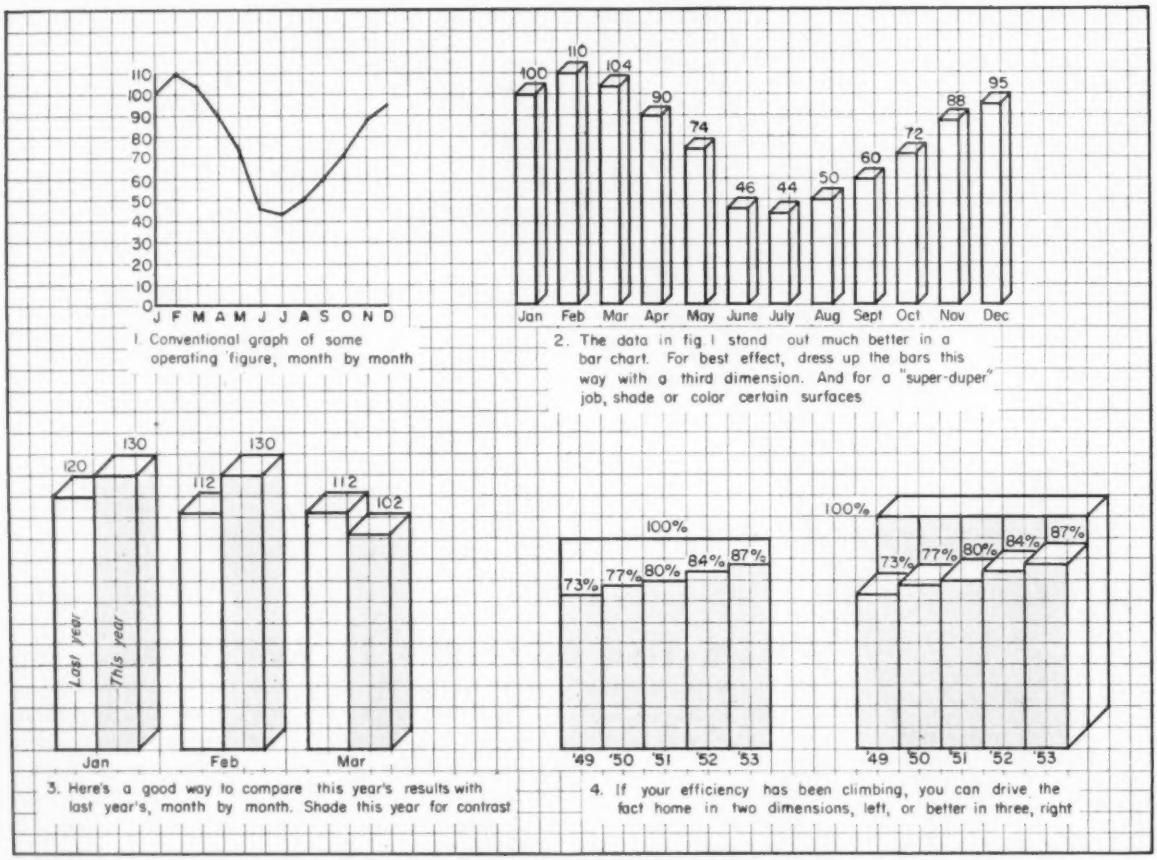
HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH



1. Conventional graph of some operating figure, month by month

2. The data in fig. 1 stand out much better in a bar chart. For best effect, dress up the bars this way with a third dimension. And for a "super-duper" job, shade or color certain surfaces

3. Here's a good way to compare this year's results with last year's, month by month. Shade this year for contrast

4. If your efficiency has been climbing, you can drive the fact home in two dimensions, left, or better in three, right

Easy Sketching System—11

► So FAR, we have seen how to use "cabinet" sketches to show mechanical objects or arrangements — machines, piping, hookups, bins, structures, etc. Now let's look at some "decorative" uses: Three-dimensional charts are commonly used to liven up statistical articles in magazines. They can do the same for the operating reports power engineers make to top management.

For example, let's start with Fig. 1, a rather dull-looking curve, reporting some operating figure for every month of the year. It might be coal or fuel oil consumed. If so, it represents a lot of money and deserves emphasis.

Picture charting, Fig. 2, will make these figures look as important as they really are. This figure is the exact equivalent of Fig. 1, with a third dimension added.

Fig. 3 shows another stunt, using the same 3-dimension bars. Here, month by month, you compare this year's results with last year's. To make the comparison stand out more sharply, you can shade this year's results and leave last year's unshaded.

Fig. 4, left, is a good way to show how your boiler efficiency has been climbing in recent years, say from 73% to 87%. Fig. 4, right, adds a third dimension. Note how the slanting lines are here drawn *down left* from the top of the original 2-dimension bars shown at the left.

When you include such 3-dimensional charts to drive home key operating results in reports to executives, the effect is generally improved if the squared paper does not show. Lay a piece of tracing paper over the squared paper to make your sketch. Then you can submit either the original tracing or the blueprint. Remember, it often helps to shade or color.

Next month's "Headwork" will show more ways to dress up statistical facts.

You Get Time-Tested Dependability With

NAVCO Counterpoise*

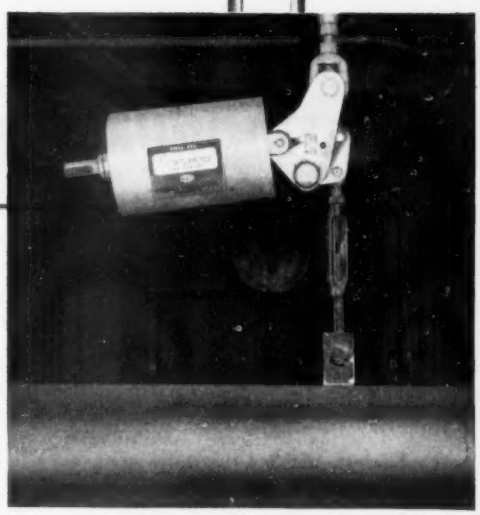
Pipe Hangers

The constant load-carrying capacity of Navco Counterpoise* Pipe Hangers has been proven during an extended period of satisfactory service as the first accurate and efficient support for high temperature piping systems. They are being used extensively in steam generating stations, refineries and chemical plants.

The Counterpoise Hanger is a spring-actuated counterbalance. An ingenious system of linkage transforms the varying force of the spring in an accurate mathematical ratio to produce a load supporting effort of constant value throughout the entire range of expansion travel.

The design permits great flexibility of installation and saves valuable space in congested areas. All parts are ruggedly made and have a high safety factor, yet excess weight and oversize physical dimensions have been avoided to hold space and structural load requirements to a minimum.

The Navco Counterpoise Hanger is available in 16 different frame sizes with load capacities ranging from 200 to 16,000 pounds and expansion travels up to 12 inches. For detailed information on how you can get dependable support with this unique hanger, write today for our 12-page illustrated bulletin #153.



Note above how the flexible top connection permits the hanger assembly to fall in line with the direction of the load pull, so that horizontal travel of the piping has no appreciable effect on the hanger operation. The unit may be positioned at any angle. This affords flexibility in installations where close clearances are a factor.

* *Counterpoise is a trade name of the National Valve & Manufacturing Company*

NATIONAL VALVE & MANUFACTURING COMPANY

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"In that case, she can jump," said Marmy, "because she is getting heat right now."

Marmaduke's Flying Propeller

► EVERY MARINE BOILER has a bottom-blow valve and a surface-blow valve. And every time we see a letter on the right or wrong way to install a blowdown valve we think of Marmaduke Surfaceblow. Then we wonder if his name has any connection with marine boilers.

Now that readers have had their chance to get into that valve argument (see "Arguments," in the last few issues) we thought Marmy might like to lock it up by putting in his oar. When we entered the old consulting engineer's dingy office above O'Houlihan's Machine Shop and Engine Works, we found him burning up someone at the other end of his telephone.

"If she threw a propeller blade, radio your chief engineer to slow her down until she doesn't vibrate. Keep running at that speed until you can get her into shipyard. THAT'S WHAT I SAID. And don't worry. I once ran all the way from Seattle to New York with a blade off."

Slamming down the receiver he spotted me. "Make it snappy," blasted Marmy. "This is my busy day."

"How about settling that argument in POWER on installing blowdown valves with the pressure under or over the seat," I began.

"BILGEWATER ON BLOWDOWN VALVES," bellowed Marmy. "I'll tell you about a ship's propeller that almost knocked itself out."

With that he hoisted his feet onto his roll-top desk. Then he reached over to the potbellied stove, grabbed the coffee pot and poured himself a cup of black stuff that looked and smelled like bunker-C fuel.

Before I could ask why this sudden change from Sandpaper Gin, he put the steaming cup down and roared:

"Back in 1913 I was Chief on the freighter SS *Valparaiso*. She was a steam reduction-gear job. We carried general cargo to the west coast of South America. On our return trip we brought back copper, fruit, coffee and nitrate.

"The *Valparaiso* was an old ship. But my engineers were good, hard-working men who had all come up through the foc's'le. They kept that old rust bucket running on schedule.

"One trip the *Valparaiso* pulled into Mobile, Alabama, to dry dock for the annual shipyard overhaul. Besides all the repairs we were doing below, the shipyard was to pull our tail shaft. That meant removing the propeller and breaking the 4-in.-diameter coupling bolts on the 16-in.-diameter tail shaft down in the shaft alley.

"Because a tail shaft is flanged on the inboard side, it must be removed by pulling it back through the stern tube inside the ship, after the propeller is off. To do that, the last piece of shafting before the tail shaft must be lifted out of the way. And a 16-in.-diameter shaft of about 10-ft length isn't light. Then the tail shaft is pulled inside through the stern tube to be examined.

"The shaft alley is narrow, with a catwalk along the shaft. And the shafting bolted together is from 100 to 150 ft long, depending on distance between engine and propeller. Every ten feet there are large spring bearings supporting the shaft.

"The 4-in.-diameter coupling bolts

(*Continued on page* 172)

Photomicrograph of one type of silica scale in early formation stage. Further deposits will fill in between the "trees" to form a dense, glass-hard, insulating covering that is extremely difficult to remove—and impervious to usual water treatment techniques.

STONE FOREST

(The boiler scale that fought back)

When silica scale was mentioned, water-treatment experts used to change the subject quickly . . . until a plant using The Nalco System began having scaling troubles due to high silica content of the raw water.

That was many years ago. Today, the same plant, operating at 135 psi, maintains 500 ppm (29.4 grains per gallon) silica in boiler water without scaling.

The Nalco research program that solved this low-pressure boiler water silica problem is a continuous one, so that today The Nalco System successfully meets the challenge of silica wherever it arises in the field of water conditioning.

Whether your water treatment problem is silica—or something even tougher—Nalco has the solution, or can put the full facilities of the Nalco Laboratories to work on it for you.

LATEST STUDY ON SILICA CARRY-OVER

At operating pressures over 400 psi another silica problem—that of silica carry-over—often arises. One of the 1951 ASME papers, "Correlation of Silica Carry-over and Solubility Studies" is an up-to-the-minute, informative discussion of this problem. You are welcome to a copy. Just write to National Aluminate Corporation.

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Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE *Nalco*®

SYSTEM . . . Serving Industry through Practical Applied Science

JENKINS PRACTICAL PIPING LAYOUTS 68

How to plan a

HIGH PRESSURE — HIGH TEMPERATURE HOT WATER PIPING SYSTEM

For many applications, a high pressure—high temperature system, like the one illustrated here, offers several distinct advantages over a steam system. It provides for efficient space heating and water heating, and also for numerous processing needs, such as dye vats, plating tanks and evaporators.

Often operated at pressures up to 215 psi, with a corresponding temperature of 388°F, a HP-HT system of this type employs a simpler piping design that eliminates the need for pitch, drainage, or traps. It provides a far greater amount of heat transmission for a given pipe size and, since makeup is extremely low, requires no feed-water treatment. Also, when this system is used for processing services, there are no large pressure drops due to sudden load conditions.

The hot water is generated in a shell and tube heat exchanger by means of high pressure steam from either turbine extraction or turbine exhaust. A closed expansion tank maintains constant pressure within the system. Water is circulated by regular closed expansion tank maintains constant pressure boiler feed type centrifugal pumps to all uses. A high pressure makeup pump delivers the small amount of makeup required. As shown in the diagram a recording and integrating Btu meter indicates thermal energy consumed by equipment.

Unit heaters on the HP-HT lines provide for space heating requirements. A shell and tube heat exchanger supplies warm water for lavatories, kitchens, and processing which requires moderate temperatures.

When accumulators are used another important advantage of this system is the storage of steam in excess of the HP-HT demand. This feature is particularly desirable when the load on the turbine from which the steam is extracted or exhausted is not in coincidence with the system's demand. Under these circumstances, steam may be drawn from the accumulators to meet the increased HP-HT requirements. Thus, the need for taking additional steam directly from the steam generating source is decreased or eliminated, with a better plant heat balance as a direct result.

Jenkins Fig. 1010-CM Cast Steel Gate Valves are recommended for the thermostatic steam admission valve shutoffs in this system. For 300 lb. service, at temperatures to 850°F, they are made of carbon molybdenum alloy steel, with stainless steel wedges (up to 8″ size) and H-monel seat rings. The rising spindle serves to indicate the position of the wedge. Operating threads are on the outside, allowing easy cleaning and lubrication.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17. Sold through Leading Industrial Distributors everywhere.

Rising Spindle
CAST STEEL GATE VALVE
300 lb.
Steam or Water
To 850°F
Fig. 1010-CM
Solid Wedge — O. S. & Y.

The *extra* measure of efficiency and endurance built into *all* Jenkins Valves is a distinguishing feature of Jenkins Cast Steel Valves. Compare the quality, and see why it pays to specify *Jenkins.* A new catalog of Cast Steel Valves gives detailed pressure ratings, dimensions, and other technical data covering all patterns. Send for your copy.

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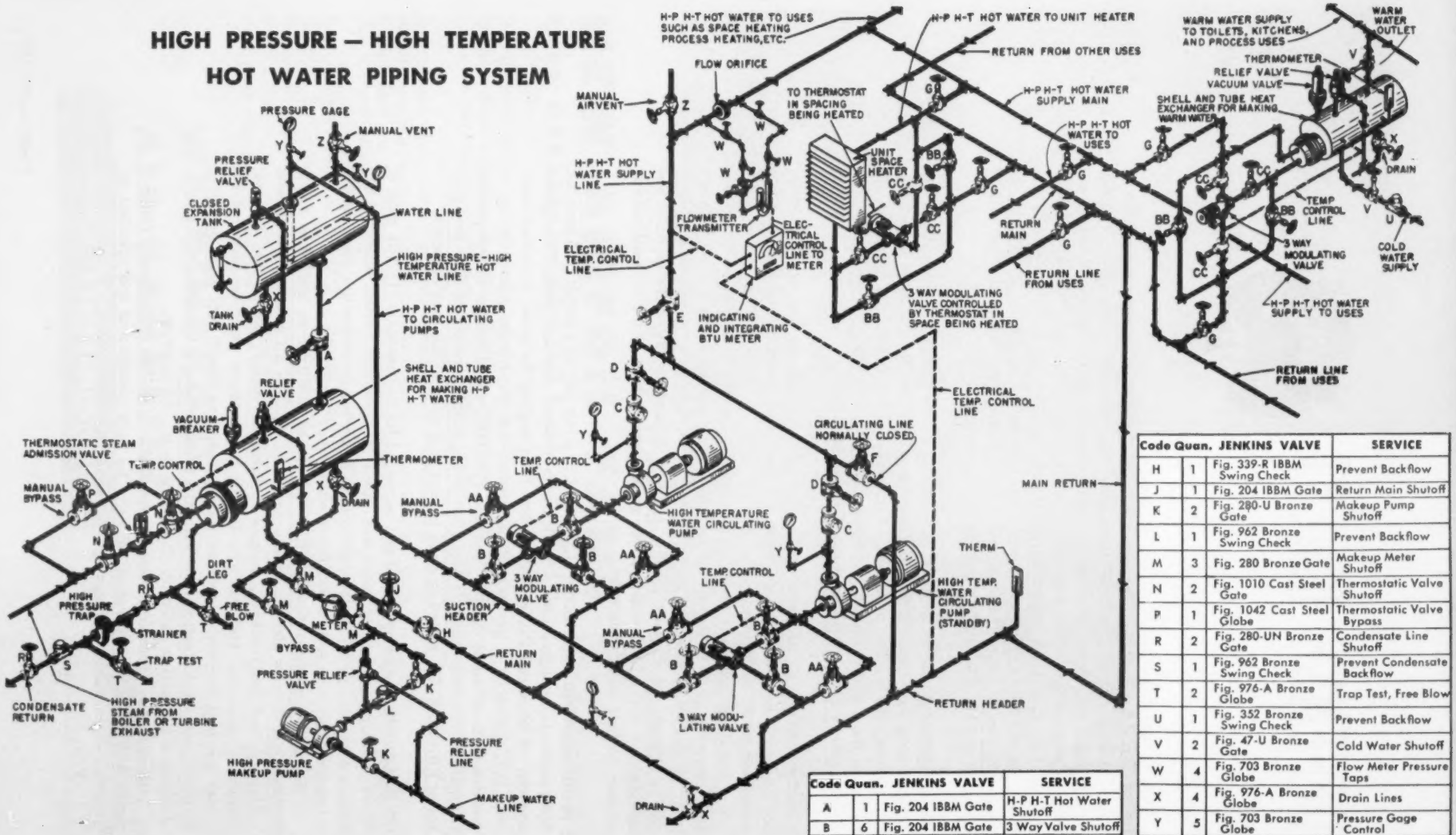
HIGH PRESSURE — HIGH TEMPERATURE HOT WATER PIPING SYSTEM



Code	Quan.	JENKINS VALVE	SERVICE
A	1	Fig. 204 IBBM Gate	H-P H-T Hot Water Shutoff
B	6	Fig. 204 IBBM Gate	3 Way Valve Shutoff
C	2	Fig. 339-R IBBM Swing Check	Prevent Backflow
D	2	Fig. 204 IBBM Gate	Pump Discharge Shutoff
E	1	Fig. 204 IBBM Gate	Supply Line Shutoff
F	1	Fig. 923 IBBM Globe	Circulating Line Shutoff
G	6	Fig. 280 Bronze Gate	Branch Shutoffs

Code	Quan.	JENKINS VALVE	SERVICE
H	1	Fig. 339-R IBBM Swing Check	Prevent Backflow
J	1	Fig. 204 IBBM Gate	Return Main Shutoff
K	2	Fig. 280-U Bronze Gate	Makeup Pump Shutoff
L	1	Fig. 962 Bronze Swing Check	Prevent Backflow
M	3	Fig. 280 Bronze Gate	Makeup Meter Shutoff
N	2	Fig. 1010 Cast Steel Gate	Thermostatic Valve Shutoff
P	1	Fig. 1042 Cast Steel Globe	Thermostatic Valve Bypass
R	2	Fig. 280-UN Bronze Gate	Condensate Line Shutoff
S	1	Fig. 962 Bronze Swing Check	Prevent Condensate Backflow
T	2	Fig. 976-A Bronze Globe	Trap Test, Free Blow
U	1	Fig. 352 Bronze Swing Check	Prevent Backflow
V	2	Fig. 47-U Bronze Gate	Cold Water Shutoff
W	4	Fig. 703 Bronze Globe	Flow Meter Pressure Taps
X	4	Fig. 976-A Bronze Globe	Drain Lines
Y	5	Fig. 703 Bronze Globe	Pressure Gage Control
Z	2	Fig. 976-A Bronze Globe	Air Vents
AA	4	Fig. 923 IBBM Globe	3 Way Valve Bypass
BB	4	Fig. 976-A Bronze Globe	3 Way Valve Bypass
CC	6	Fig. 280 Bronze Gate	3 Way Valve Shutoff

Diagram by Huxley Madeheim, Consulting Engineer

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For details of valves to suit varying conditions, see Jenkins Catalog.

DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

Termination of DEPA (Defense Electric Power Administration) came on June 30 in wake of elimination of Controlled Materials Plan. Since its creation Dec. 4, 1950, this claimant agency for the electric-power industry guided and expedited an expansion program that added more than 14-million kw to the nation's facilities.

On Jan. 1, 1951, installed capability totaled about 67.5-million kw. By the beginning of 1953 this had grown to 81.5-million and is scheduled to go to 113.5-million by Jan. 1, 1956. If the current program keeps step, 9.5-million kw will be installed in 1953, 10.5-million in 1954 and 12-million in 1955.

End of nickel shortage seems in sight as result of a new contract for production expansion made by Defense Materials Procurement Agency. Beginning in Dec. 1953, International Nickel Co. of Canada, Ltd. will deliver metal from low-grade ore bodies in the Sudbury district of Ontario. This will add about 10% to normal U.S. supply, greatly ease severe shortage of nickel for alloys.

Private atomic-energy development will almost certainly get the nod from Congress, but maybe not until next year. Congress action is still awaited on Niagara Falls power and the St. Lawrence seaway project.

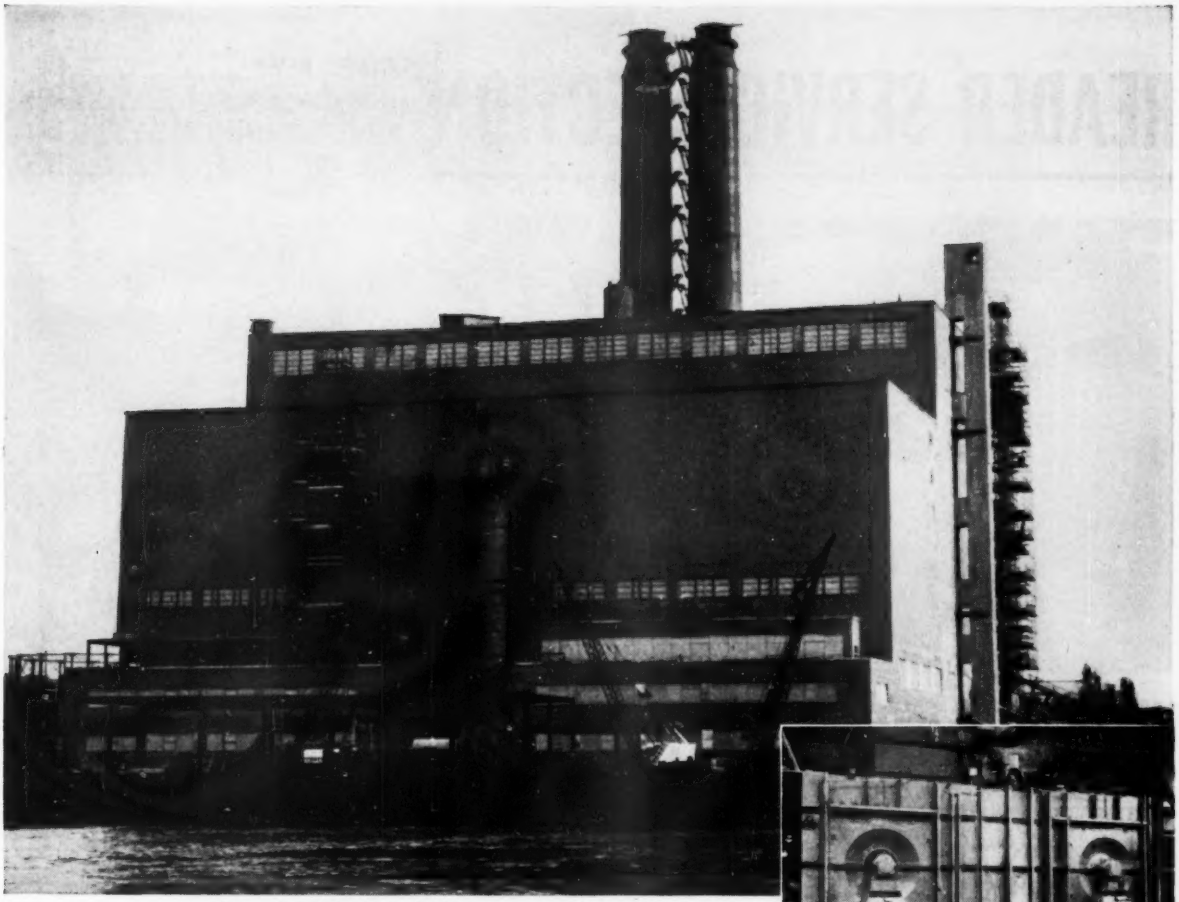
Federal government is pretty well out of the Niagara Falls picture but private development still faces opposition from New York's pressure for a state "monopoly." On the St. Lawrence, Federal Power Commission gave New York a preliminary go-ahead, recommends issuing a 50-yr license to the state to build and operate part of the $600-million power project, an element of the over-all seaway program so long under discussion.

Aluminum from Canada will bolster U.S. output in a big way as a result of Aluminium Ltd. contracts to supply over a million tons between now and 1959. This parent company of Aluminum Co. of Canada has been angling for years to secure long-term U.S. contracts – government or private. U.S. buyers are Aluminum Co. of America (600,000 tons), Kaiser Aluminum (186,000), and a number of independent fabricators (320,000). Alcan is now considering doubling output of huge new project at Kitimat, B. C., slated to come in next year with 90,000 tons capacity.

Mobilization agencies are being pruned and regrouped for two reasons: (1) With most of Korea buildup complete or under way, need for operating control agencies has largely disappeared. (2) Better organization is needed for peacetime planning and a fast shift into high gear in any future emergency.

Key of the reorganization is Office of Defense Mobilization, headed by Arthur S Flemming. As now planned, it will deal with virtually all mobilization phases: production and requirements, materials, financial policy, nonmilitary defense, manpower, economic stabilization. It will thus assume many functions of the former National Security Resources Board, Munitions Board, etc. Some operating functions in the mobilization field will still be farmed out – a handful will stay on at National Production Authority (Commerce Dept), for example.

Big gain from necessarily complicated shuffling will be much greater centralization of industrial-mobilization authority for more coordinated and speedier action. New organization will lean heavily on advisory committees.



Astoria's 1,200,000 lb. boilers are among the world's largest. Sturtevant fans furnish 600,000 CFM forced draft on each.

NEW AIRFOIL FANS

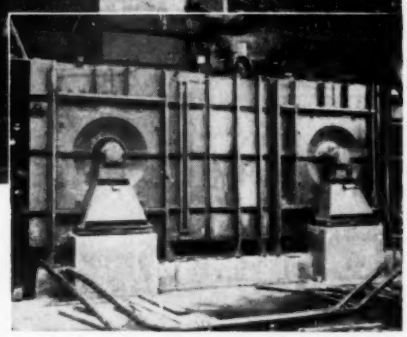
GIVE GREATEST ECONOMY AT ASTORIA

Pressurized boilers at Consolidated Edison's Astoria Station are designed to operate without induced draft. In a fan arrangement never before used by a public utility, eight new Sturtevant Airfoil-Bladed Fans are connected in series of two for forced draft.

Each tandem is rated for 300,000 CFM at 38" pressure. At part loads, only one fan of each pair is used. Thus the fans operate at or near peak efficiency at all times.

Airfoil-Bladed Fans retain the self-limiting horsepower characteristics and reach peak efficiencies of *over 90%*. They are designed primarily for application where low operating cost and quiet operation mean more than first cost.

For full information on the Airfoil-Bladed Centrifugal Fan, ask for new Catalog 1320. Call your Westinghouse-Sturtevant office. Westinghouse Electric Corp., Sturtevant Division, Hyde Park 36, Mass.



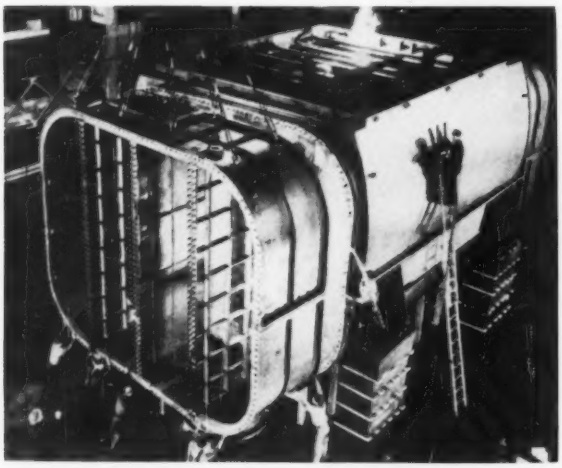
The "boxcar" being installed above houses two Airfoil Fans in tandem. Two units totaling four fans serve each boiler. A unique by-pass system permits operation of any two fans in each four-fan unit. All fans are equipped with power-saving Vane Control® to permit instantaneous control of output.

WESTINGHOUSE AIR HANDLING

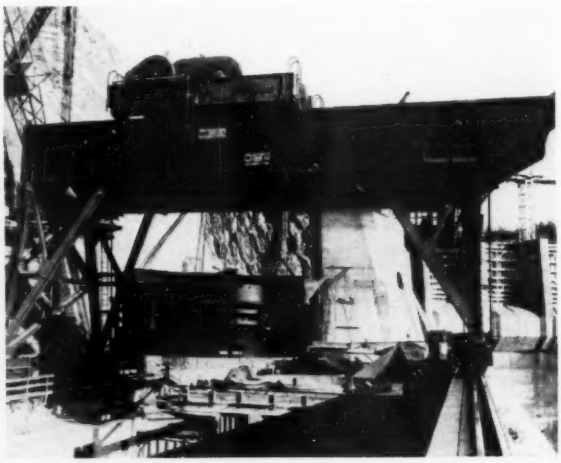
YOU CAN BE SURE...IF IT'S Westinghouse

READER SERVICE SECTION

POWER NEWS_____150
TECHNICAL BRIEFS_____152
PLANT EQUIPMENT NEWS_____156
NEW FREE BULLETINS_____165



LARGEST STEAM CONDENSER in the world is under construction at Worthington Corp's Harrison, N. J. works. This 125,000 sq ft condenser will serve a 180,000-kw turbine generator at Consolidated Edison Co's East River Station in New York



NEW 275-TON GANTRY CRANE is now serving Washington Water Power Co. Designed by Bedford Foundry & Machine Co to handle rotors weighing up to 330 tons each, it will be used at new Cabinet George Hydro Station near Clark Fork, Idaho

Double-Reheat Plant Runs at 4500 Psi

► A NEW BOILER and turbo-generating plant has been designed to cross the barrier of the critical pressure of steam for the first time in the commercial production of electric power. This plant will utilize steam at 4500 psi and 1150 F.

Philip Sporn, president of American Gas and Electric Co; Alfred Iddles, president of Babcock & Wilcox Co and Glenn B Warren, vice-president of General Electric Co and general manager of its Turbine Division have announced plans to build the new unit.

After months of study and design, these companies have agreed that General Electric will design and manufacture a 120,000-kw turbine while Babcock & Wilcox will design and build the boiler for it. At 4500 psi, the turbine will be operating at almost double the present highest steam pressure used for power generation.

The initial steam temperature of 1150 F will be 50 degrees above the current high and will be followed by two stages of reheat—the first at 1050 F and the second at 1000 F. The boiler will be the "once-through" universal-pressure type in which water at 5500 psi changes into super-heated steam in a single passage through the boiler tubes. The revolutionary cyclone furnaces will insure rapid and complete burning of the coal and will prevent air pollution.

The entire project, costing in excess of $12 million, is being engineered by American Gas and Electric Service Corp, a subsidiary of American Gas and Electric Co. The new unit will be installed under Service Corp supervision at Ohio Power Co's Philo plant near Zanesville, Ohio.

In behalf of the three companies associated with the project, Sporn stated, "While the use of boilers above the critical pressure of 3206 psi has been considered and while laboratory pressures above that value have been utilized, no practical design has ever been developed." He explained that, in the super critical pressure range, water passes immediately into steam. There is no intermediate stage of "bubbling" such as is seen in a pot of boiling water or such as exists in a boiler operating at any pressure below critical.

The use of this universal-pressure type boiler means that the boiler drum and the recirculating pumps can be eliminated. The boiler drum, used to separate the bubbles of steam from the water, is the biggest and heaviest single item in a power plant.

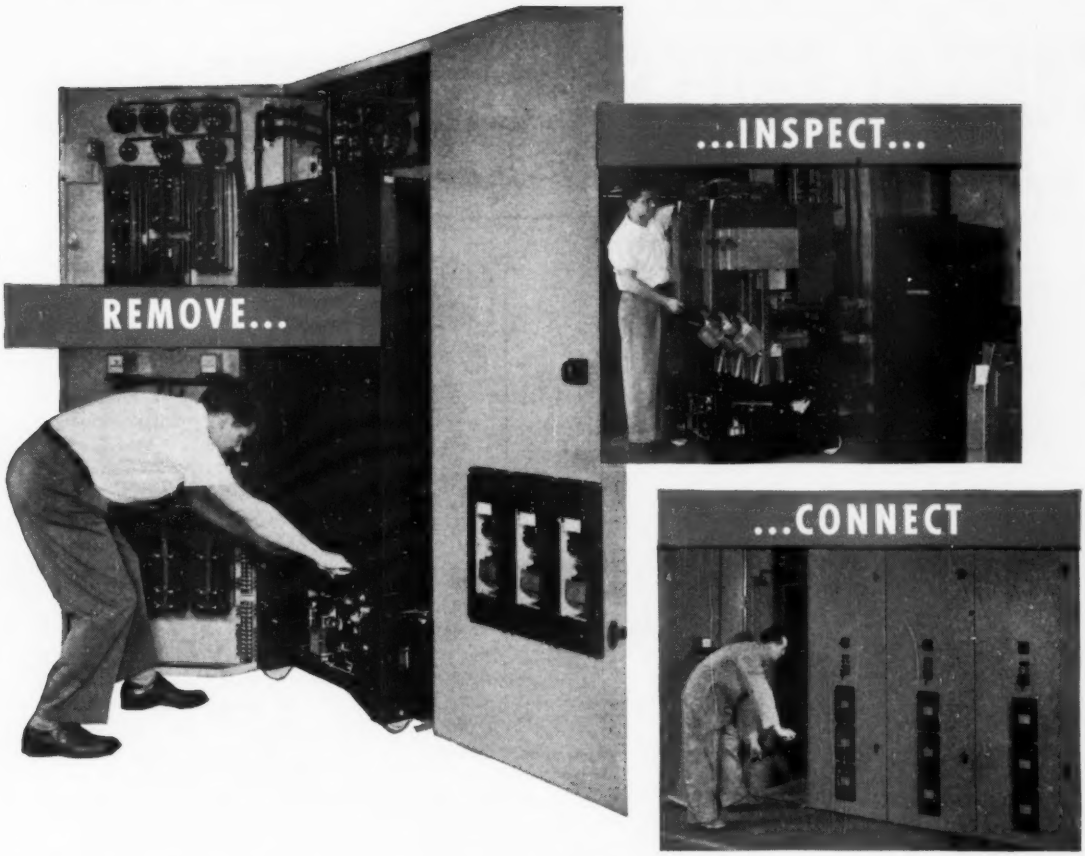
"It is this that in part makes the 'once-through' idea so attractive," Sporn said. "The boiler becomes, in effect, a continuous run of tubing into which water is pumped at one end and out of which highly super-heated steam is delivered at the other." In such a boiler the feedwater is not delivered to a central drum. Instead, it passes directly from a newly-designed feed-pump through the boiler unit and is converted into superheated steam in one passage.

The principle of reheating steam is used in the most modern power plants to use practically every ounce of energy. In the new Philo generating unit the double reheat method will realize even greater efficiencies. This process involves leading the steam back into the boiler setting twice for reheating during its passage through the turbine.

"Successful development of power generation at this new plateau of higher pressures and temperatures eventually will make possible still higher pressures, temperatures and additional reheats with resulting efficiencies hardly

(*Continued on page* 218)

For coming events see page 218



It's easier, faster, safer with Westinghouse horizontal drawout switchgear!

You can remove breakers, inspect them, and replace them in only a few minutes when you use Westinghouse Type DH Metal-Clad Switchgear. Because breakers are drawn out horizontally, no lowering or lifting is necessary. A shutter indicator, visible from the front, provides positive indication of disconnect position. As the breaker is withdrawn, a grounded metal shutter closes to isolate stationary contacts.

When the breaker is removed, interphase barrier and arc chutes remove easily to expose contacts at an accessible and convenient working height for quick inspection.

Replacing the breaker is just as easy and safe. A few easy turns of a crank move the breaker from disconnect to operating position. A mechanical interlock positively prevents engagement of crank linkage unless the breaker is open.

For complete information on Westinghouse Metal-Clad Switchgear for indoor or outdoor service write for Booklet B-5306. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-60792

DESIGN TESTED AND VERIFIED in the Westinghouse HIGH POWER LABORATORY

YOU CAN BE SURE...IF IT'S Westinghouse

METAL-CLAD SWITCHGEAR

TECHNICAL BRIEFS

Latest engineering developments for busy power men

12 Digests for you on:

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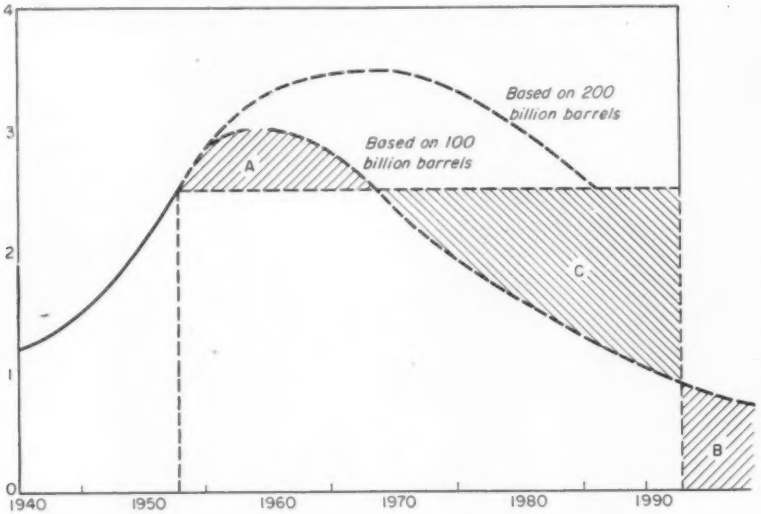
ATOMIC POWER
PACKAGED DRIVES
POLLUTION CONTROL



1 Oil production, extrapolated to 1993 and based on 200 and 100 billion barrels recoverable, shows the effect of reserves on expected production peak years

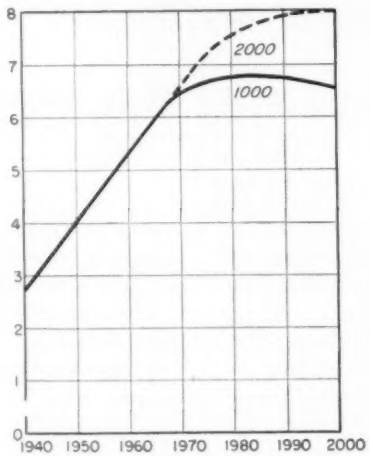
How Much Oil?

The Long Range Outlook for Liquid Fuels in America. *By Eugene Ayres, Gulf Research & Development Co.*

In January of last year a report was presented on "Petroleum Productive Capacity" by the Committee on Oil and Gas Availability of the National Petroleum Council. This report is commended for study because it represents conclusions of the most competent people in the petroleum industry.

During the past ninety years the world has depended almost exclusively upon natural petroleum for liquid fuel. Less than a tenth of one percent has come from oil shale and coal. The reason for this has been economic. As long as we have an adequate supply of cheap petroleum we will not seek more expensive substitutes. The small amount of supplemental fuel so far used has been surplus benzol and tar from by-product coke ovens, and shale oil and fermentation alcohol produced as occasional slight gestures toward political expediency. How long will cheap petroleum be in adequate supply? The answer hinges on four numbers—supply and demand in the U.S. and supply and demand in the rest of the world.

How about demand for the rest of the world? The rest of the world is increasing its consumption more rapidly than we are. The most obvious explanation is that the rest of the world has a far greater margin for technological improvement and for potential demand than we have.



2 Politics, wars determine world production peak in billions of barrels

In Fig. 1, production of oil in the United States is extrapolated to 1993 based on ultimate recoverable reserve figures of 100 and 200 billion barrels. You will note that doubling the reserve postpones the peak of production from 1960 to 1970. If the lower number is right, evidence should appear in three or four years in the form of somewhat less increase in production rate. Even if the higher figure is right the evidence should appear by 1960.

The production curve for the world is shown in Fig 2. An ultimate reserve of 1000 billion barrels has less foundation in geologic data than estimates for the United States. Most petroleum people feel that political and economic hurdles in foreign countries may retard discovery to such an extent that the peak may not reach as high as seven billion barrels, and may therefore descend less abruptly than shown. (A thousand billion barrels is ten times the present "proved" reserve.) Even if ultimate world reserve turn out to be double that now assumed by geologists, the peak should come by the end of this century. *APC Paper, no number.*

Industry and Atoms

Why Atomic Power. *By W L Davidson.*

Last September the Commission informed Congress' Joint Committee on Atomic Energy that it was working on the Atomic Energy Commission's position for the development of economic nuclear power. Hearings on "industrial participation" are anticipated shortly by the Joint Committee at which time the Commission's stand will be made public. It should be recognized that this broad problem of nuclear power development is bound to affect other areas of government and the views of other agencies in the Executive Branch must necessarily be factored into any final program which may be adopted by the Congress.

In spite of the wide attention given the general subject of atomic power over the past seven years, most discussions have centered on the means and a timetable for achieving a nuclear power industry rather than the reasons for it; in other words, the how and when of getting atomic power—not the why. In its search to establish a position or this subject, the AEC could not start at such an advanced point of departure. This would assume that the desirability of pushing toward nuclear power is already clearly established.

(Continued on page 154)

How to make packings last longer

Tips by Johns-Manville Engineers to help you keep production rolling

...and this new chart makes it easy to choose the right J-M Packings for your power plant equipment

A handy 6-page guide, "Johns-Manville Packings for the Power Plant" simplifies the selection and application of power plant packings. Covering 32 of our most popular styles, it tells at a glance what J-M packings to use... why they are recommended... and how to install them.

Its schematic diagram is spot-keyed to help you locate packing styles for various equipment units. Its brief group-headings help you select J-M packings for centrifugal and rotary services, reciprocating rods and plungers, valve stems, pipe flanges, manholes and handholes... to seal against steam, water, oil, brine, etc.... to withstand various temperatures and pressures. Its condensed packing descriptions give you essential buying information.

And a page is devoted to tips on proper installation to help you get maximum economy and efficiency from your Johns-Manville packings.

Your local Johns-Manville Packing Distributor will be glad to give you a copy of this handy packing selector, free of charge. Or write to Johns-Manville, Box 60, New York 16, N. Y., asking for Brochure PK-61A. In Canada, address 199 Bay Street, Toronto 1, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

More TECHNICAL BRIEFS

Begins on page 152

The negative side of civilian nuclear power development holds (1) that coal is so abundant in this country we should let other nations where coal is scarce develop the technology for use of the new nuclear fuel, (2) that a strong civilian nuclear power program would seriously reduce the military effort in this field and, because of the declassification necessary, would compromise security. And last but not least, such a program would cost millions of dollars.

Summarizing the situation favoring nuclear power development now, there is the prestige value to be gained, the matter of foreign competition, the optimistic views on the current economics of nuclear power, by-product military benefits, assuring maximum return from our military investment in the atom, provisions of the Atomic Energy Act permitting civilian development and the present enthusiasm in industry to join with government in the search for commercial nuclear power. *APC Paper, no number.*

Economic Evaluation of the Industrial Use of Atomic Energy. *By Walker L Cisler, The Detroit Edison Co.*

Although many industrial uses of atomic energy are contemplated, the practical uses, for the present, seem to be (1) production of radioactive isotopes for numerous purposes, and (2) use of the vast amount of heat energy released by the fission of atoms of uranium (U-233 and U-235) and plutonium (Pu-239). This heat will be used for production of steam which in turn can be used for generation of electric power or for other industrial purposes. For the sake of simplicity, this discussion will concern chiefly the generation of electric power.

The questions first asked about the use of atomic energy for the generation of electric power are (1) is it physically possible at this time? and (2) how much will it cost?

The first of these questions has been answered affirmatively many times. Dr Walter H Zinn, in a paper presented at this meeting has told us of the exceedingly difficult problems which are involved and indicated that ways of meeting these problems can be found. He has also told us of the experimental breeder reactor at Arco, Idaho where the generation of comparatively small amounts of electricity using the heat of nuclear fission has actually been accomplished.

The second question, how much will it cost, is much more perplexing. It involves many different problems and unfortunately cannot be answered specifically at this time. The best we can do is to make a rather broad economic evaluation of several aspects of the development to show why atomic energy is of such vital importance to our country and to the world, and to point out areas in which energy derived from nuclear fission will be of great economic value. The aspects to be considered include (1) the potential fuel resources of the world, and their importance to civilization, (2) the utilization of our naturally fissionable and fertile materials, and (3) the justifiable costs of heat power reactors.

In undertaking an economic evaluation of this kind we should bring into focus the goals which we are striving to achieve. The electric power industry has long balanced costs in the effort to provide power to the ultimate consumers in the most economical manner. It has weighed the cost of producing power in thermal plants located at mine mouths as compared with location near the load centers. It has made studies of the overall costs of supplying power from thermal plants as compared with hydroelectric plants. And from these studies decisions have been made concerning the methods of supplying electricity to our power systems and to the ultimate customers at the lowest possible costs, consistent with good service standards.

Atomic energy provides us with a new source of fuel. It is attractive to us because we hope to be able to utilize it to produce electric power at a cost less than that incurred with the present conventional fuels or with the energy of falling water—hydro-electric generation.

Unless we can accomplish this goal, electric power systems or those industries that provide self-generation cannot justify the large scale use of atomic fuels for power generation. Consumers cannot be expected to pay a higher cost for electricity simply because it is produced by using atomic fuels. It is understood, of course, that all proper credits and debits for by-products produced in the operation of nuclear reactors must be included in determining real costs of power produced with atomic fuels.

The goals, therefore, are to develop practical commercial installations which will produce electric power at as low or lower costs than present day power generating plants.

From the standpoint of reactor design, construction and operation, the economic possibilities look bright indeed, but we still are in the development stage. We believe that costs of reactors for the generation of electric power can be brought within reason and that an important new segment of industry may result. We believe, too, that there may be many auxiliary effects which will contribute greatly to an improved economy for our country. *APC Paper, no number.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from sources, not POWER.

American Power Conference, annual meeting, Sherman Hotel, Chicago, Ill., Mar 24-27, 1953. Identified by initials APC and obtainable in proceedings printed and distributed by R A Budenholzer, chairman, Illinois Institute of Technology, 3300 Federal St, Chicago 16, Ill. $6.00.

American Institute of Electrical Engineers, winter general meeting, Statler Hotel, New York, N. Y., Jan 19-23, 1953. Identified by initials AIEE and obtainable through AIEE, 33 W 39th St, New York 18, N. Y.

Manufacturing Chemists' Association, Inc, Water and Air Pollution Abatement Conferences, Oct 23-24, 1952, Netherland Plaza Hotel, Cincinnati, Ohio and Feb 26-27, 1953, Hotel Statler, Detroit, Mich. Identified by initials MPC and obtainable from Manufacturing Chemists' Assn, 246 Woodward Bldg, Washington 5, D. C.

Packaged Drives

Construction, Components and Control of Packaged Adjustable-Voltage Drives. *By Gerald Secor, Cutler Hammer, Inc, Milwaukee, Wis.*

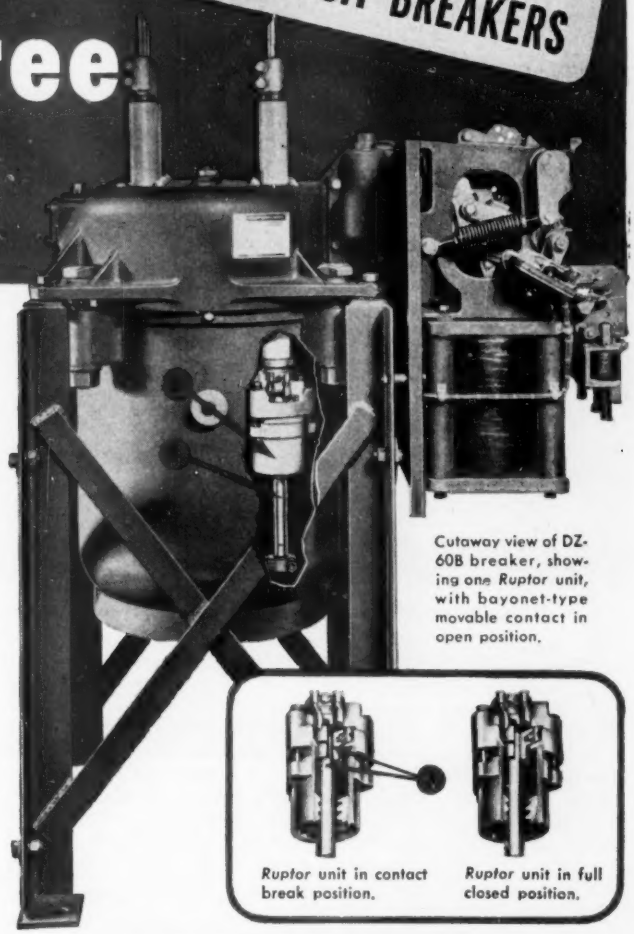
Advantages of packaged adjustable-voltage drives and the components which make up the control that uses a dc generator for the adjustable-voltage power supply are presented. Probably the greatest advantage of a packaged adjustable-voltage drive is that all the equipment required to supply the adjustable voltage is mounted in a single, ventilated enclosure. The ac drive motor, starter, start-stop pushbutton, dc generator and control panel are mounted in the enclosure complete with connections. Thus, the user need only

(*Continued on page* 204)

Three Reasons Why

...Years of Trouble-Free Service

ALLIS-CHALMERS
Indoor
OIL CIRCUIT BREAKERS



Cutaway view of DZ-60B breaker, showing one *Ruptor* unit, with bayonet-type movable contact in open position.

Ruptor unit in contact break position.

Ruptor unit in full closed position.

One **Few moving parts!**

Bayonet contacts (1) are the only moving parts of the *Ruptor* interrupting device.

Two **Easy inspection!**

Drop the tank, and the bayonet contacts are visible in open position. For access to the stationary contacts, one needs only to remove four bolts and cylindrical shell (2).

Three **Self-aligning and Self-cleaning contacts!**

Tulip and bayonet contacts (3) maintain high conductivity without readjustment or cleaning. Arc energy is minimized by efficient interruption within oil-filled *Ruptor* unit. This in turn contributes to long contact life and low oil deterioration.

In addition, a mechanically trip-free solenoid operating mechanism controls contacts of time-proved *Ruptor* interrupting devices And pole unit mechanism is self-lubricated — completely enclosed — sealed from dust, dirt, corrosion.

In brief, Allis-Chalmers DZ breakers are built to assure years of dependable, trouble-free service.

Allis-Chalmers power circuit breakers are available in ratings from 2.5 to 230 kv, with interrupting capacities from 15,000 to 10,000,000 kva, to meet all industrial and power company requirements. For more information, call your nearby A-C representative, or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4057

Ruptor is an Allis-Chalmers trademark.

TYPE	RATED KV	MINIMUM KV AT RATED KVA	RATED AMPS	KVA INT. CAPACITY
DZ-40B*	7.2	2.3	600	100,000
			1200	100,000
			2000	100,000
DZ-60B†	13.8	4.0	600	150,000
			1200	150,000
DZ-100B†	13.8	4.0	1200	250,000
DZ-200B†	13.8	6.6	1200	500,000
			2000	500,000

*Ask for Bulletin 71B6179. †Ask for Bulletin 71B6129.

ALLIS-CHALMERS

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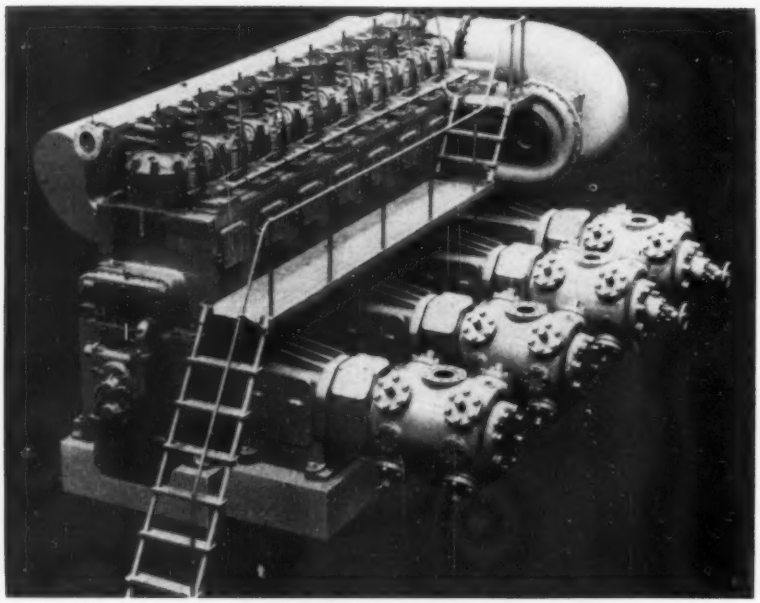
Published monthly as a service to readers



Turbocharged 2-Cycle Gas-Engine-Driven Compressor

701 • Model TRA is claimed to be America's first turbocharged 2-cycle right angle gas-engine-driven compressor.

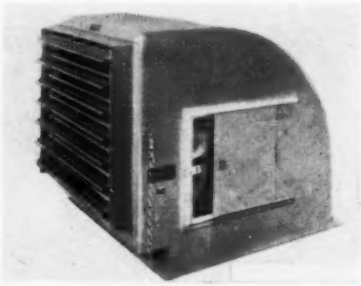
The TRA-8 develops 1320 bhp, has eight vertical in-line cylinders of 14 in. bore and 14 in. stroke, integrally connected to horizontal compressor cylinders.

Manufacturer claims these advantages: 50% more power than non-turbocharged units of comparable bore and stroke; lower fuel consumption; 25% less cooling water per bhp; practically constant fuel consumption between 70% of load and maximum; quiet operation with no exhaust pulsations.

The turbocharger uses the waste heat, velocity and mass flow of the exhaust gases to drive a radial inflow turbine. The turbine is integrally connected to a centrifugal compressor that pumps air for scavenging power cylinders and provides air for combustion. Engine drives the turbocharger at start-up and on light loads. At other load conditions, turbocharger operates independently of engine.

The compressor features 2-cycle in-line design, and manufacturer claims that it has excellent balance. Bulletin 130.

Clark Bros Co, Olean, N. Y.

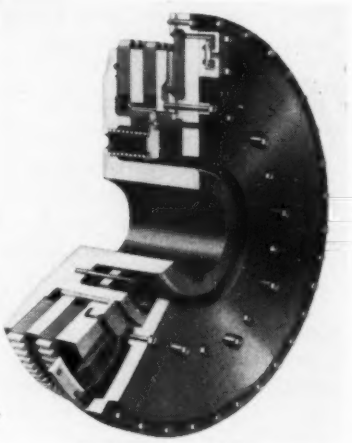


Penthouse Fan

740 • Type PH and PHD fans are streamlined to reduce air impact and rumble, and undercoated with noise-deadening material. Front section has by-pass tray to discharge rain water back to the roof.

Sizes 12 to 60 in., 5000 to 40,000 cfm. PH takes belt drive fan, PHD direct drive fan. Bulletin 510.

Chelsea Fan & Blower Co, Inc, 639 South Ave, Plainfield, N. J.



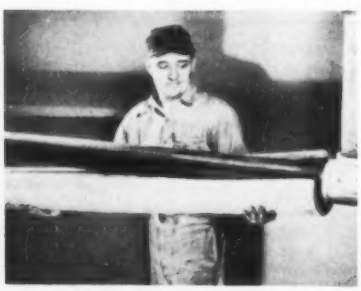
Air-Actuated Clutch

711 • Model PO is designed to handle higher torque capacity loads with more compactness than the company's previous lines of air-actuated clutches. Unit has lighter weight and narrower clutch width, can be installed in less shaft space, with closer shaft-bearing center distances.

Air-cooled springs effect positive plate release and equal distribution of release pressure. Air actuation is accomplished through insulated and air-cooled diaphragms. Unit is available at present in two and three plate models, 24 in. size.

Twin Disc Clutch Co, Racine, Wis.

(*Continued on page* 158)



Glass Fiber Insulation

721 • *Ultrafine* pipe insulation is a one-piece molded fine glass fiber insulation. It is made of fine blown glass fibers bonded with a phenolic resin and molded into one piece sections, 6 ft long. Manufacturer claims it will not rot, mold, decay or absorb moisture. It resists the attack of most acids and alkalis and is not corrosive to metals.

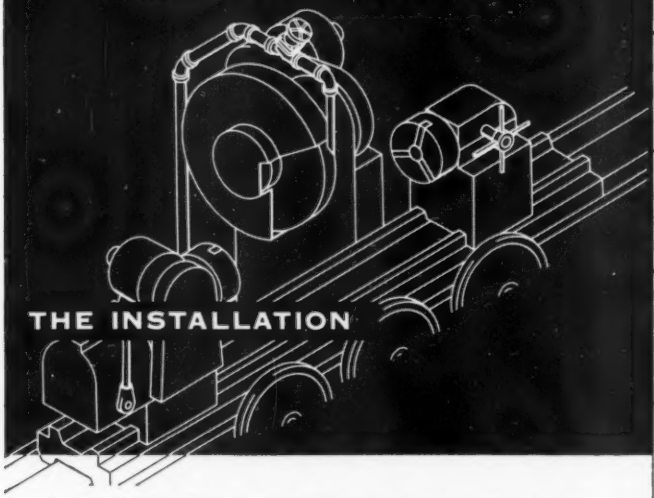
This insulation is suited for all heated piping applications up to 350 F and for low temperature applications of all types.

Among advantages claimed are exceptional thermal efficiency, light weight, flexibility, resilience.

Gustin-Bacon Mfg Co, 210 W 10th St, Kansas City, Mo.

For more data on these items, use post cards p. 165. Identify your request with item number.

How this Valve Solved a Costly Problem ... on Abrasive Fluid, for instance



THE INSTALLATION

At Standard Crankshaft & Hydraulic Co., Inc., Charlotte, N. C., with Crane diaphragm valves on regrinding machines, controlling flow of grinding solution to the work.

VALVE SERVICE RATINGS

SUITABILITY: Far better than expected

FEATURES: Pliable neoprene disc insert

MAINTENANCE COST: Zero

SERVICE LIFE: Now 8 times longer than other valves

OPERATING RESULTS: Forced machine down time stopped

AVAILABILITY: Crane catalog item—No. 1610

THE CASE HISTORY

About 3 weeks was the maximum service life of the conventional globe valves formerly on these machines. Their disc and seat were quickly cut out by the abrasive and steel dust that mixed with the re-circulated lubricant. Keeping up with replacements was costly in valves as well as extended machine down time.

Crane 1610 Diaphragm Valves were selected to help if not remedy the situation. They would last longer. Their pliable Neoprene disc insert would absorb the foreign particles that cause leakage and wire-drawing in ordinary valves. And when needed, a disc could be renewed in a few minutes.

But results were far better than expected. The Crane valves installed more than 6 months ago are still in service with no repairs; show no sign of trouble. Naturally, these valves have been put on all grinders.

THE VALVE

Neoprene disc insert seating is but one feature of Crane Packless Diaphragm Valves. Their sealed bonnet isolates working parts from line fluid. Independent disc and diaphragm design reduces diaphragm wear; permits closure on fluid even should diaphragm fail. These valves come in many body and trim materials for corrosive, abrasive, or common services. See your Crane Catalog or Crane Representative.

THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

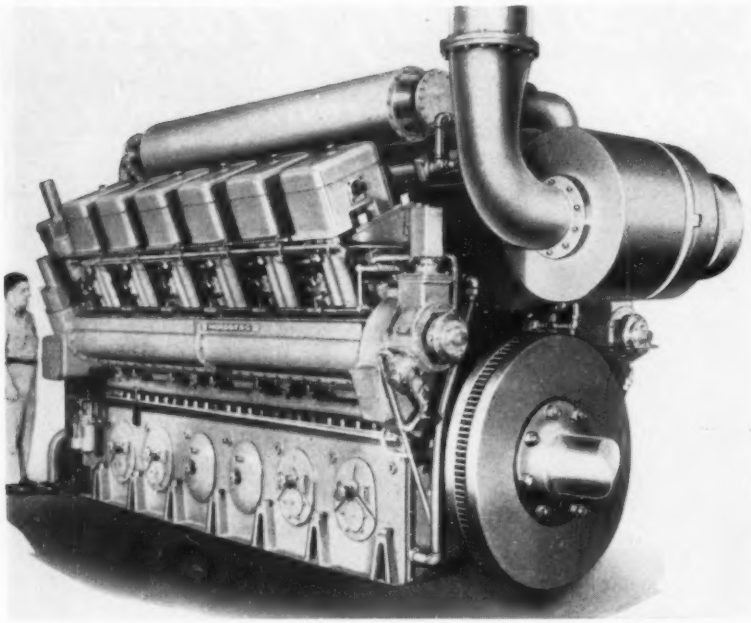
CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

More EQUIPMENT NEWS

Begins on page 156



V-Type Diesel Engines Cover Range From 2400 to 4260 Hp

726 • Four-cycle *Supairthermal* V-type engines for stationary and marine service are heavy-duty prime movers of moderate weight and small physical dimensions. With 12 or 16 cylinders (13 x 16½ in.), they cover a range from 2400 to 4260 hp at 450 to 600 rpm.

Built for liquid fuel, duafuel or spark-fired gas operation, design incorporates all performance features of 13-in. bore in-line *Supairthermal* engines. Many of the important parts of the V-type engine are identical and interchangeable with in-line-type parts.

Included angle of cylinder banks is 45 degrees, offset between cylinders on each crankpin is 4¾ in. Net weight of 12-cylinder engine is 96,000 lb, and of 16-cylinder, 122,000 lb, not including flywheel and extension shaft.

Inlet air manifold and single-duct exhaust manifold are directly under housing of 2-pass intercooler which runs full length of the engine. For stationary use, turbocharger is at free end, for marine use, at drive end.

Counterweighted crankshaft is carried in the frame, supported by lower transverse members. Steel bearing caps are keyed to these members and held in place by two steel through bolts.

Heat-treated alloy steel is used in engine frame, bedplate, crankshaft, connecting rods, etc. Frame is welded and stress relieved.

Removable cast-iron cylinder liners seat in individual cast-iron jackets. This permits directed flow of cooling water. Entire cylinder assembly with liner is easily removable without disturbing liner water seals. Exhaust and intake valves seat directly in cylinder heads for maximum cooling.

All moving parts are pressure lubricated. Rotary lubricating-oil pumps are driven by roller chain from end of crankshaft.

For oil operation, a constant-stroke fuel-injection pump of variable cut-off type is used. Easily removable fuel nozzle holders have spring-loaded valves and multiple-hole tips. For duafuel or spark-ignition operation a hydraulically-actuated gas admission valve is used. For spark-firing there are also two spark plugs per cylinder and low-tension impulse generators, rectifiers and transformers. Each engine has hydraulic-relay overspeed and control governors mounted at the flywheel end.

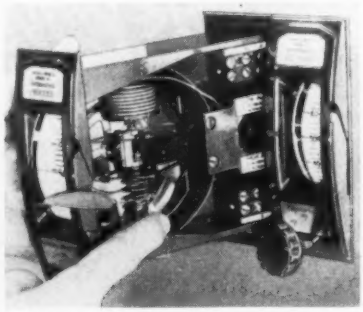
Engine is suited for continuous operation in many stationary applications. The marine engines are available in direct-reversing types for direct drive, single or multiple drive through reduction gears with electric or hydraulic couplings or for diesel-electric drive.

Nordberg Mfg Co, Milwaukee 1, Wis.

Plastic Electrical Tape

717 • New splicing tape for all electrical applications contains a pressure-sensitive compound. It is claimed to resist weather, corrosive chemicals, water, oils and abrasion. Tape is extra thin with high tensile strength and adhesive qualities, and is said to conform readily to irregular surfaces. Dielectric strength averages over 1000 volts per mil of thickness, meeting UL specifications. Available in 60 and 20 ft rolls in ¾ in. widths, and a 12½-ft roll at ½ in.

Boston Woven Hose & Rubber Co, P O Box 1071, Boston 3, Mass.



Miniature Remote Indicator

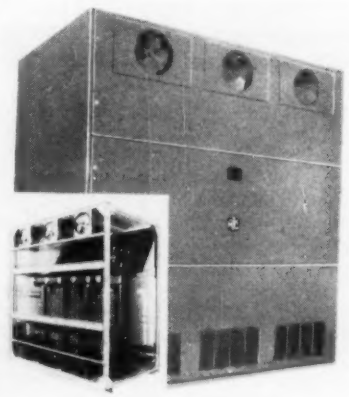
712 • Miniature indicator in new *Ratographic* series has total scale length of 5¾ in., calibrated from 0 to 100. Scale is mounted on a rotating drum, and positioned by a pneumatic signal from any remotely-located primary or secondary instrument. Accuracy is 0.5% of full scale.

A variety of alarms and operating guides can be incorporated into the instrument. These include: distinctive strip widths; adjustable color guides; automatic alarm contacts.

The indicator is pneumatically operated, with full scale travel obtained between 3 and 15 psi on standard models. Overall dimensions are 5⅝ by 2⅜ by 7¾ in.

Fischer & Porter Co, 11 Jacksonville Rd, Hatboro, Pa.

For more data on these items, use post cards p. 165. Identify your request with item number.



Dry-Type Dual-Rated Transformer

722 • New insulated transformer has two blowers mounted in the housing and a thermostat in the coils. One rating covers operation without the blowers, at which time the transformer is naturally cooled. When heat reaches a certain level, thermostat activates the blowers, and forced-air cooling increases transformer's rating by 33 1/3%.

Available in ratings from 100 to 3000 kva and up to 15,000 v.

Marcus Transformer Co, Hillside, N. J.

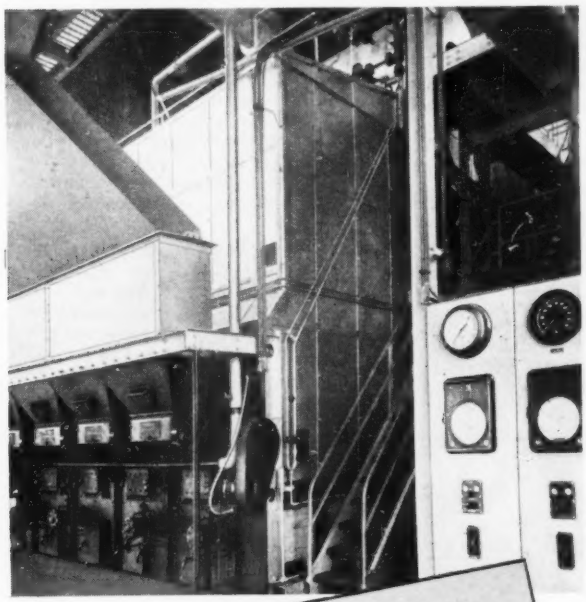
(*Continued on page* 160)

"HOW WE SAVE MORE THAN $90,000 A YEAR—

BY BURNING COAL THE MODERN WAY!"

says W. H. FISHER, Plant Engineer, Kerr Bleaching and Finishing Works, Concord, North Carolina.

"Powering our plant used to take nine boilers—now *one* does the same job *using 30% less fuel!* 6 firemen now do the work of 18—thanks to modern coal-handling equipment and automatic controls. That's why we say, you can't beat bituminous coal burned with modern equipment."



Above is a view of the plant's modern, space-saving coal-storage silo. To the left is a close-up of the firing aisle, showing the spreader stoker and the main control panel. Coal handling is automatic and dust-tight throughout. Automatic controls regulate firing, drafts and feed-water—give maximum efficiency at lowest cost.

If you operate your own steam plant, you can't afford to ignore these few down-to-earth facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U. S. A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

Burning coal the modern way can save *you* money, too! First, labor costs can be cut to a minimum with up-to-date coal- and ash-handling equipment. On top of that, today's combustion installations give you 10 to 40% more power from each ton of coal than was possible a few years ago!

If you're planning to modernize, or if you're building a new plant, call in a consulting engineer. He'll show you how you can get big savings by burning coal in a modern plant designed to meet your *specific* needs.

America's coal reserves are virtually inexhaustible; America's coal industry is the world's most productive and efficient. That's why coal has a future dependability of supply that no other fuel can offer. That's why, of all fuels, the price of coal is most likely to remain stable.

BITUMINOUS COAL INSTITUTE

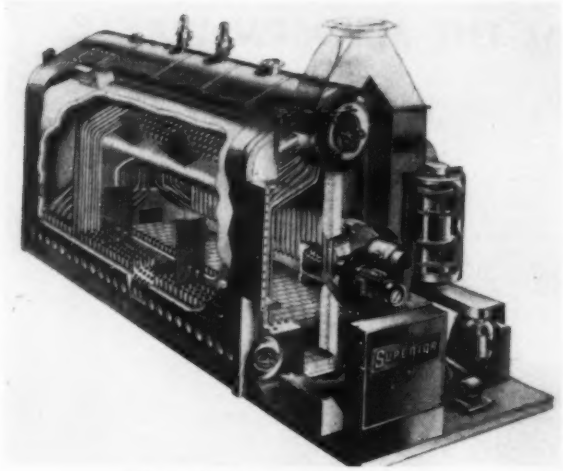
A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

More EQUIPMENT NEWS

Begins on page 156



Water-Tube Steam Generator

716 • These packaged generators are available in 9 sizes with capacities ranging from 5300 to 33,000 lb per hr, and for pressures up to 400 psi. Units are built on a structural steel base, requiring no brick setting or special foundation. They can be furnished for permanent outdoor installation.

The boilers are of the "A" type construction. Unobstructed floor of the firebox makes the design readily adaptable to stoker installation.

Specially designed induced draft system uses dual fans and divided second pass to provide flexibility of firing range.

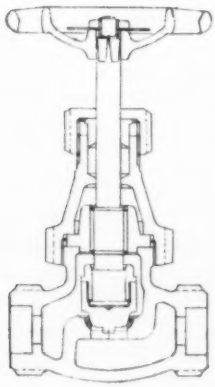
Superior Combustion Industries, Inc, Room 305, 1475 Broadway, New York, N. Y.

Steam Trap

723 • No. 814, side inlet, side outlet steam trap has 1 or 1¼ in. threaded connections. Body and cap are cast semi-steel; valve and seat hardened chrome steel; interior trim stainless steel.

Capacities range up to 6800 lb per hr, pressure range is 0 to 250 psi. Height is 13⅝ in., diameter 9 in., weight 45 lbs.

Armstrong Machine Works, Three Rivers, Mich.

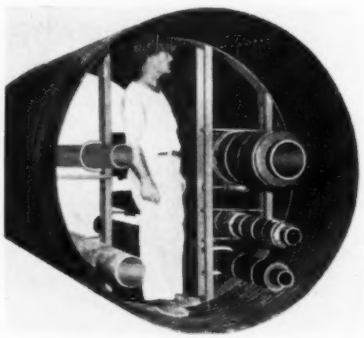


600-lb Valve

736 • Redesigned line of 600-lb small steel globe, angle and check-list valves features a "full-way" plug type disk with increased seating width and a new chromium stainless steel seat that eliminates seat rings.

Disk is made of type 420 stainless steel, with a 500 Brinell hardness. Seat is type 410 stainless, with a 350 Brinell hardness. No seat rings are required, and the hard metals prevent disk and seat scoring, manufacturer claims.

Lunkenheimer Co, Cincinnati 14, Ohio.



Prefabricated Tunnel Piping System

734 • Large-diameter conduit system protects underground distribution piping and other utility services. *Utilidor* system is prefabricated for job requirements with distribution piping for steam, condensate, water lines, fire lines, or process purposes all in place and insulated where required, including traps, valves and expansion devices.

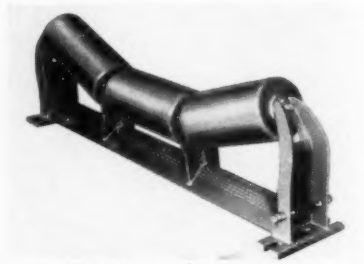
Provision may be made for electrical and communication cables, lights, etc. Conduit is shipped in 21 ft sections with simple joint connections. Diameters range from 36 to 84 in. depending on the nature and number of services to be housed.

Ric-wiL Co, Union Commerce Bldg, Cleveland 14, Ohio.

Lightweight Fire Hose

706 • *Highflex* hose is made with synthetic fiber, weighs about 20 lb less per 100 ft than standard hose. Manufacturer claims the special Dacron fiber is three times stronger than the same weight of cord previously used.

B F Goodrich Co, Akron, Ohio.



Belt Conveyor Carrier

724 • Series 220 carriers have spun end rolls and welded steel frame. Seamless steel tube houses tapered roller bearing and is bored for precision alignment between roller diameter and bearing. Labyrinth seal protects bearing, which can be adjusted by taking up nuts.

Flexible high-pressure lubrication tubes can be arranged for three-shot lubrication from one or both sides of conveyor. Assemblies and parts are interchangeable.

Stephens-Adamson Mfg Co, Aurora, Ill.

(*Continued on page 162*)

For more data on these items, use post cards p. 165. Identify your request with item number.

Don't Forget to SPECIFY REVERE

CONDENSER TUBES AND PLATES

Year after year users of condenser tubes and plates specify Revere, not only for new equipment, but when re-tubing. You might consider this fact if you are not as yet a Revere customer.

Correct specification is vitally important, because conditions vary so greatly. Each installation presents an individual combination of factors, each one of which should be studied before deciding on the proper alloy. It is often advisable to make a new survey of the situation before re-tubing, because the nature of the cooling water may have changed, or other service alterations have taken place.

To find the alloy or combination of alloys best suited to meet a specific set of circumstances, Revere offers the help of its Research Department, made available through the Technical Advisory Service. Working with the country's leading users of condensers and heat exchangers, these capable consultants have helped solve many and varied types of problems, leading to longer tube life.

Revere makes tubes and tube sheets in all the customary alloys. See the nearest Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

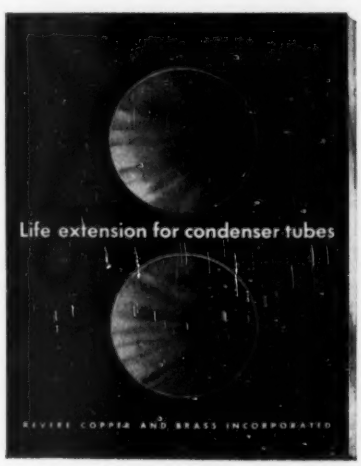
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y. Sales Offices in Principal Cities, Distributors Everywhere.

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

This 28-page booklet is of unusual interest in these times when it is more important than ever to squeeze every last day of use out of condenser and heat exchanger tubes. It includes data on various copper alloys, photos of different types of condenser tube corrosion, and photomicrographs of the grain structure of different metals under varying operating conditions. Write on your firm's letterhead for your free copy. Ask for "Life Extension for Condenser Tubes."

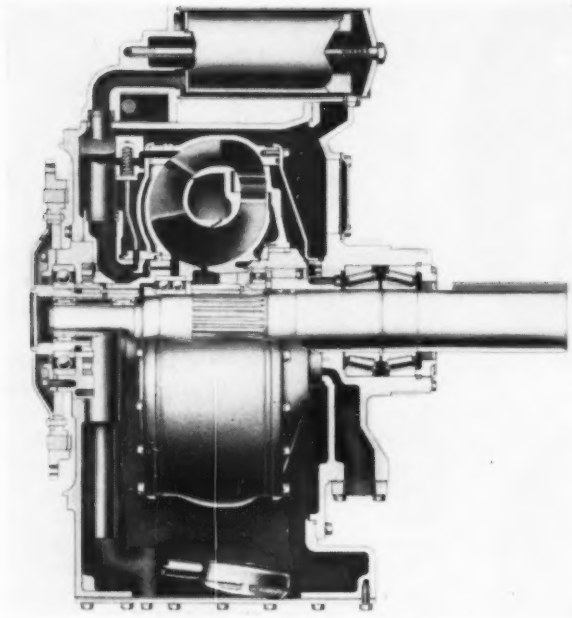


More EQUIPMENT NEWS

Begins on page 156

CHECK THESE TOO! . . .

Orifice meter . . . . . p 184
Speed control valve . . . . . p 186
Pressure-operated valve . . . . . p 188
Welding transformer . . . . . p 190
Standard control panel . . . . . p 192
Boiler water solids test . . . . . p 196
Dye penetrant test . . . . . p 198
Oil-actuated clutch . . . . . p 200
Bolt-end insulator . . . . . p 202



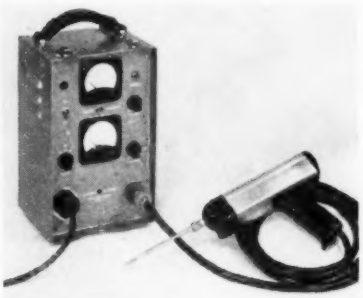
Hydraulic Torque Converter

737 • New two-stage hydraulic torque converter develops up to 4 to 1 torque multiplication at stall, combined with progressively increasing engine speed during acceleration and uniform pull-down under load.

Unit features free-wheel reaction or stator blades, providing complete unloading of the engine at high-speed, no-load conditions, with low horsepower absorption. The basic unit, Model S, offers a standard spider-drive input, has a built-in converter charging pump around the input shaft. Inlet and outlet connections are provided for piping the fluid to and from a cooler. Output shaft can be either straight or flanged.

Model SD incorporates the additional design features of quick-release dump valves to permit releasing oil from the converter circuit, and a 2-position control valve for actuating the dump valves.

Twin Disc Clutch Co, Hydraulic Div, Rockford, Ill.



Leak Detector

730 • Redesigned halogen-sensitive leak detector permits easier detection of leaks in closed circuits like refrigerator and air conditioning systems, tanks, boilers, piping, etc.

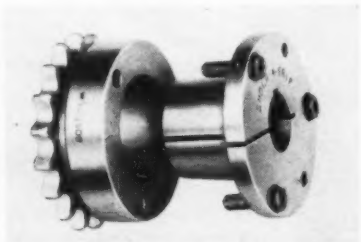
The new unit, type H-1, features a loud-speaker in the control unit for audible indication of leaks. There is also an automatic balancing circuit to compensate for changes in background air contamination, and a new light-weight internal voltage stabilizer.

General Electric Co, Schenectady 5, N. Y.

Circuit Tester

744 • *Circuitracer* locates grounds, opens or shorts in dead or live circuits. Unit will trace virtually all types of circuits for continuity and presence of either ac or dc voltage, manufacturer states. Live circuits as low as 2 or as high as 600 volts can be traced. Unit weighs 2½ oz; has a signal light in tip at point of contact.

Delta Electrical Specialty Co, 1456 E Walnut, Pasadena, Calif.



Split-tapered Bushing

750 • Interchangeable split-tapered bushing allows use of the same size sprockets on shafts from ½ to 2½ in. diameter, in steps of 1/16 in. *Shold-a-grip* bushing is drawn into tapered hole in the sprocket by tightening cap screws. Manufacturer claims bushing grips both sprocket and shaft with the equivalent of a press fit. Mating sprockets are available from stock in sizes from ½ in. pitch up to and including 1¼ in. pitch.

Boston Gear Works, 14 Hayward St, Quincy 71, Mass.

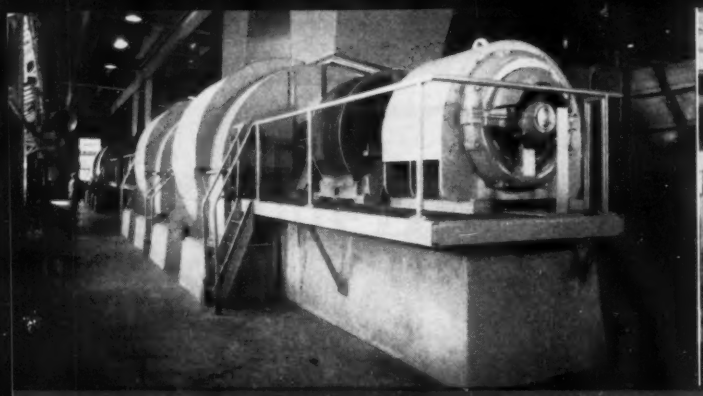
Remote Level Indicator

704 • New face and cover plate permit easier reading of liquid level. Indicator arm can now be viewed from side as well as front of the instrument.

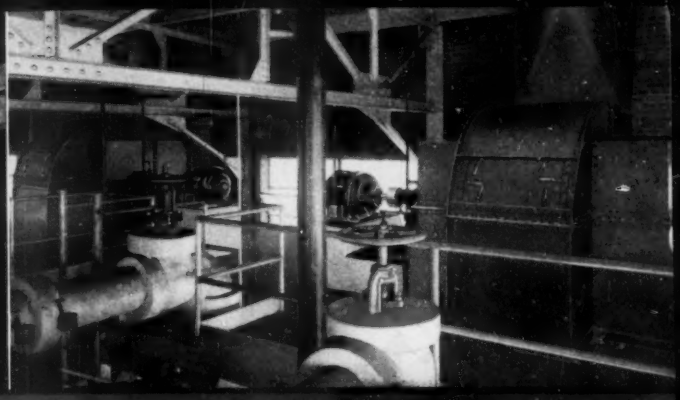
Yarway remote liquid level indicators are

(*Continued on page* 184)

For more data on these items, use post cards p. 165. Identify your request with item number.

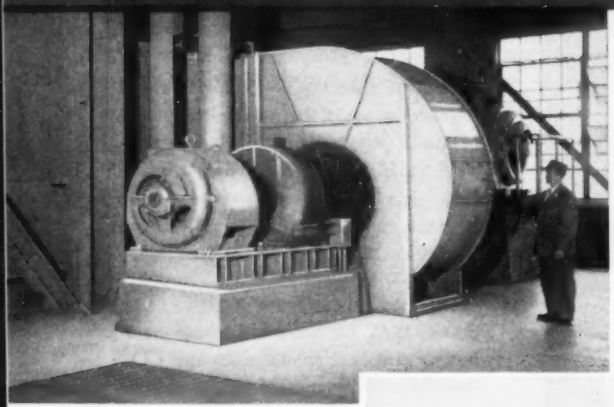


"Buffalo" INDUCED DRAFT FANS are known for their ability to stand punishment and to deliver efficiently.



"Buffalo" CINDER ELIMINATING FANS for power plants induced draft and cleaning, all in one compact unit.

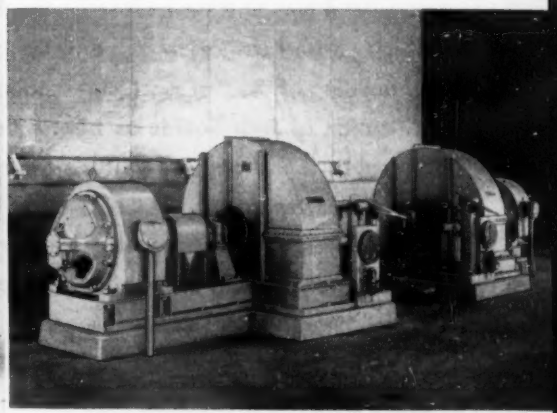
You'll Make the BEST CHOICE of DRAFT FANS from this COMPLETE LINE!



You can pick the best possible draft fan for the particular job because "Buffalo", pioneer manufacturer in the field, has developed a special fan for each job. Besides the fans illustrated here, "Buffalo" builds Sintering Fans; high-pressure Scavenging Blowers for Diesel-electric power plants; Over-fire blowers; and Industrial Exhausters for smaller induced draft installations. Why not investigate the construction and performance details that make "Buffalo" Fans the first choice for many of the country's leading power stations and plants? Write for Bulletin 3750 today, and look over this COMPLETE choice!

"Buffalo" FORCED DRAFT FANS give stable performance even when fuel bed is unusually heavy.

"Buffalo" COMBINATION DRAFT FANS are compact forced and induced draft fans with a common rotor shaft.



"Buffalo" PRIMARY AIR FANS blast pulverized coal and hot air into combustion chambers without letup.

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING FORCED DRAFT | AIR CLEANING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT PRESSURE BLOWING | EXHAUSTING

ILLCO-WAY ionXchange

serving the essential power plants of American industry

pioneers and leaders in ionXchange

ILLCO-WAY "firsts" include manufacture of the first commercial two-bed De-ionizer . . . the first commercial mixed-bed De-ionizer . . . and the development and building of the first successful installations for the purification of such liquids as beet-juice and crude glycerol by ionXchange . . . In the power field, boiler feed water treatment by ILLCO-WAY ionXchange has long meant lower operating costs and increased operating efficiency. Installations in leading plants.

ILLCO-WAY

DE-IONIZING
DE-ALKALIZING
SOFTENING

For complete data, see Sweet's File, Power Plant

ILLINOIS WATER TREATMENT CO., 853-7 Cedar St., Rockford, Illinois
141 East 44th Street, New York 17, N.Y.
Canadian Distributor, Pumps & Softeners Ltd., London, Ontario

(Advertisement)

REMOVE

per thousand gallons!

3 lbs. of dissolved solids are removed from every 8,335 lbs. of feedwater in a Midwest power plant (1,280 lbs. pressure). ILLCO-WAY ionXchange installation operates on a raw water containing 21 grains of dissolved solids—provides an effluent containing less than 1 ppm solids.

Remove dissolved solids ILLCO-WAY De-ionizers provide water free of dissolved solids, silica and CO_2. Manual or automatic controls; flow rates to meet plant requirements.

Remove hardness ILLCO-WAY Softeners (manual or fully automatic) provide any required amount of zero-soft water. Compact, economical, easy to operate.

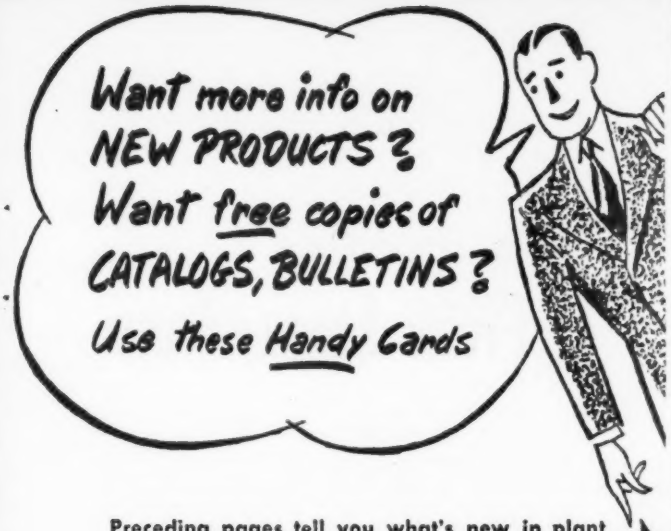
Remove alkalinity ILLCO-WAY Hydrogen Zeolite units reduce alkalinity, soften plant supply. Water with controlled alkalinity and zero hardness to meet requirements.

Send for your free copy . . .

of Bulletin "Zero," containing performance data, installation views. Please write on company letterhead. Address: Illinois Water Treatment Co., 853-7 Cedar Street, Rockford, Illinois.

Which "Zero" ?

ILLCO-WAY



Preceding pages tell you what's new in plant equipment. Each item is numbered. For more info on any of them, write in their numbers here

New free catalogs and bulletins are listed beginning on back of this page. To order those you want, write in their item numbers here

Put 2¢ stamp on self-addressed card and mail it to us. We'll pass along your requests to the various companies, they'll send the info

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- First check what you need: more information on a new product or an ad, copies of free catalogs, bulletins
- Then describe the product, or literature desired. Give model numbers, bulletin numbers wherever you can
- Be sure to write in number of page on which item appeared, and issue of POWER in which you spotted it
- Finally, address reverse side of card to the manufacturer concerned

If you like this quick, direct-to-manufacturer service, we'll gladly send you a supply of cards

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New York 36, N. Y.

I want details on these New Products... 7/53

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Send me these FREE Catalogs and Bulletins...

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My Name.....
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Title.....
Company.....
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City, State.....

Pease use before November 1, 1953. Void after this date.

GENTLEMEN: Please send me, without obligation, further information on the following: *(Check one and describe)*

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Send me these FREE Catalogs and Bulletins...

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My Name.....
Please print

Title.....

Company.....

Street Address.....

City, State.....

Pease use before November 1, 1953. Void after this date.

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TO:

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Manufacturer's name

.....
Street address

.....
City, State

GENTLEMEN: Please send me, without obligation, further information on the following: *(Check one and describe)*

☐ NEW PRODUCT ☐ ADVERTISEMENT ☐ LITERATURE

_____
Describe item here

_____

It appeared on page_____of the_____issue of POWER.

My Name .....
Please print

Title .....

Company .....

Street Address .....

City, State .....

This month's FREE Literature

AIR CONDITIONING

1 **Suspended space heaters** for general commercial and industrial use with any type gas fuel. Bulletin 543, 6 pages with photos and tables. Dravo Corp, Pittsburgh 22, Pa.

2 **Industrial heaters:** a full story on standard and heavy-duty centrifugal fan systems. Catalog 1510, 32 pages with photos, tables, and graphs. Westinghouse Sturtevant Div, Dept T-025, 200 Readville St, Boston 36, Mass.

3 **Oil mist precipitator** to remove oil mist during high-speed machining operations. Catalog E-50; 2 pages of photos, diagrams, tables. Trion Inc, 1000 Island Ave, McKees Rocks, Pa.

4 **Electronic air cleaners** for removing all dust particles from air by use of electrically charged screens. Catalog E-60, 11 pages of photos and tables. Trion Inc, 1000 Island Ave, McKees Rocks, Pa.

5 **Balanced industrial ventilation** deals with problems arising in exhaust and make up air systems. Bulletin 115, 4 pages with diagrams. National Association of Fan Manufacturers, Inc, 2159 Guardian Bldg, Detroit 26, Mich.

BOILERS AND AUXILIARIES

6 **Steam boilers:** self-contained, fully automatic boilers from 12 to 125 hp; assembled for immediate use. Bulletin A-104, 7 pages with illustrations. Eclipse Fuel Engineering Co, Rockford, Ill.

7 **Boiler baffles** to boost efficiency through streamlined gas flow across boiler tubes. 4 page leaflet with drawings showing installation. Engineering Co, 75 West St, New York 6, N. Y.

COMPRESSORS & ACCESSORIES

8 **Air cleaners and coolers** for higher efficiency in compressed air systems. Fully describes aftercoolers, separators, filters. Bulletin 177, 7 pages of drawings and tables. R P Adam Co, Inc, Buffalo 17, N. Y.

9 **Air and gas compressors:** brief description of pumps, aftercoolers, check valves for general industrial use. Bulletin 546, 6 pages with photos. Pennsylvania Pump and Compressor Co, Easton, Pa.

ELECTRICAL AND MECHANICAL CONTROLS

10 **Temperature controls** for indicating and controlling temperatures in ranges up to 3600 F. Anticipating, on-off, proportioning controls, etc. Bulletin F 5783, 4 pages with photos and graphs. Wheelco Instruments Div, Barber-Colman Co, Rockford, Ill.

11 **Air-operated controls:** instruments for automatic control of pressure, temperature, liquid level, flow, humidity, pH. Bulletin A120, 31 pages with photos and diagrams. Bristol Co, Waterbury 20, Conn.

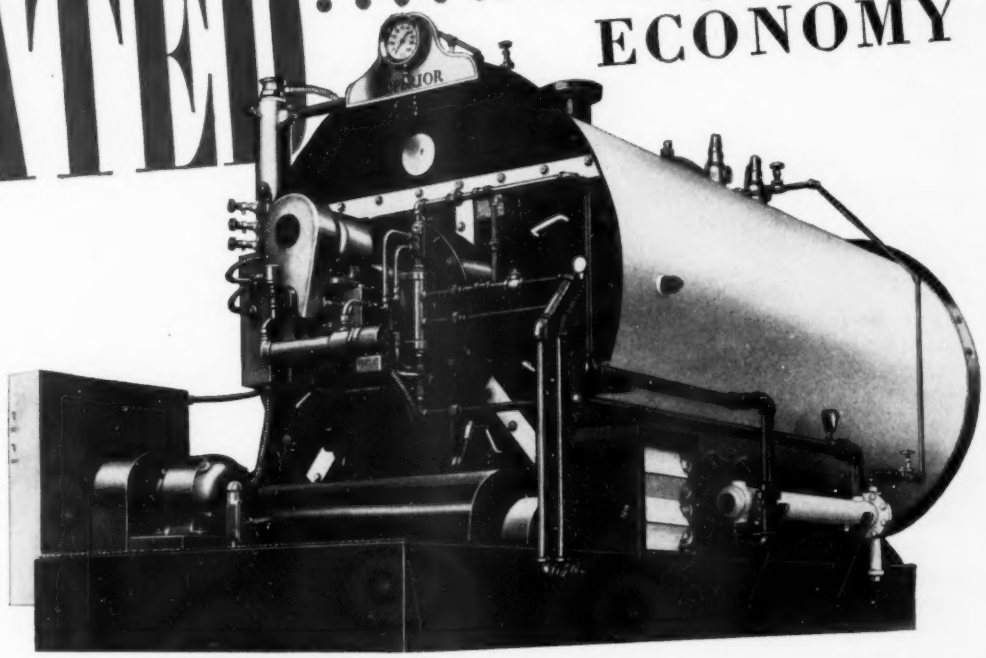
12 **Electronic pyrometer controller** shows unit plug-in construction and proportional input control action. Bulletin P1248, 7 pages with photos and drawings. Bristol Co, Waterbury 20, Conn.

13 **Industrial controls:** non-indicating electric, electronic, pneumatic controllers for temperature, pressure, humidity. Catalog 8305, 80 pages with specifications, dimension drawings, application data. Minneapolis-Honeywell Regulator Co, Sta 64, Philadelphia 44, Pa.

★ **Electric controls:** motor, switchgear, generator, marine propulsion, industrial process controls. 4-page, illustrated brochure. ★Request direct on company letterhead to Lakeshore Electric, Inc, 262 Willis St, Bedford, Ohio.

(Continued on page 232)

PERFORMANCE RATED.....for Long Lived ECONOMY



SUPERIOR STEAM GENERATORS

. . . are built to maintain full capacity operation at highest efficiencies throughout a longer serviceable life. Their full 5 sq. ft. of heating surface per b.h.p. provides maximum heat transfer at normal firing rates, assuring longer life, and eliminating the excessive maintenance and high electrical costs, caused by overfiring boilers with inadequate heat transfer surface.

Superior Steam Generators are rated for actual working performance under ordinary boiler room conditions . . . not on the basis of laboratory tests under ideal conditions.

A steam generator is a long-term investment. In the course of its life, operating savings can far outweigh initial cost. Specify Superior Steam Generators and profit from their operating savings for years to come.

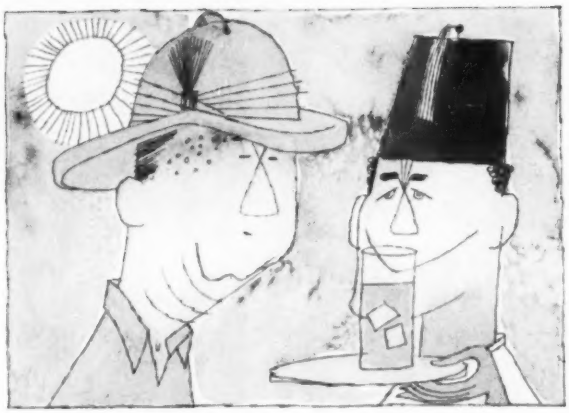
Superior Steam Generators are fully automatic, burn oil or gas or both . . . 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water. For complete details, write for catalog 500.

for performance you can **BANK** on

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR STEAM GENERATORS

George Edwards' Scrapbook



Nothing is easier than **fault finding;** no talent, no self-denial, no brains, no character are required to set up in the grumbling business.—ROBERT WEST

Now **sonic energy** is used for scrambling an egg inside the shell, setting cotton on fire with a whistle, floating cork in mid-air, making a water fountain without a pump, and many other purposes.

"So what?" was my first reaction. Then I remembered Michael Faraday's answer when he was asked what good his newly invented gadget was that generated a slight current by cutting magnetic lines of force.

"What good is a new-born babe?" was his only answer. Wish he could be around now, just long enough to see the big 300,000 kw generators that "babe" grew into.

We live in **deeds,** not years; in thoughts, not breaths;
In feelings, not in figures on a dial.
We should count time by heart-throbs.
He most lives
Who thinks most, feels the noblest, acts the best.
—PHILIP JAMES BAILEY

Said C E Deakins, Illinois Institute of Technology, "Each year the nation needs, for replacement alone, about **30,000 new engineers.** But this June colleges expect to graduate but 24,000—only 19,000 in 1954 and 17,000 in 1955."

I'm too old to shed even crocodile tears over this sad situation. We in the power field know that a product is only as good as the manufacturer's engineering department.

Yet an equipment salesman (who often has little engineering background) may earn so much more than the engineer who designs his superior product that there's little incentive for a youngster to burn the midnight oil. He can earn more money—and sooner, by following some other line. I may be wrong, but I'd like to hear from you readers.

I see where my friends at the Commonwealth Edison and Public Service of Northern Illinois have put their **radar trouble-shooter** to use. They have used it for spotting breaks in overhead electrical lines. But now they locate damaged buried cables.

This uses same principle as military radar, only here the impulses travel over a wire instead of through the air. When a fault develops in a line or cable, the fault locator is hooked up to one terminal. The radar impulse travels to the point of damage and returns. The elapsed time, translated into distance, shows about where fault is. Looks like they should save plenty of man-hours locating breaks with this method.

All truth is safe and nothing else is safe; and he who keeps back the truth, or withholds it from men, from motives of expediency, is either a coward or a criminal, or both.—MAX MULLER

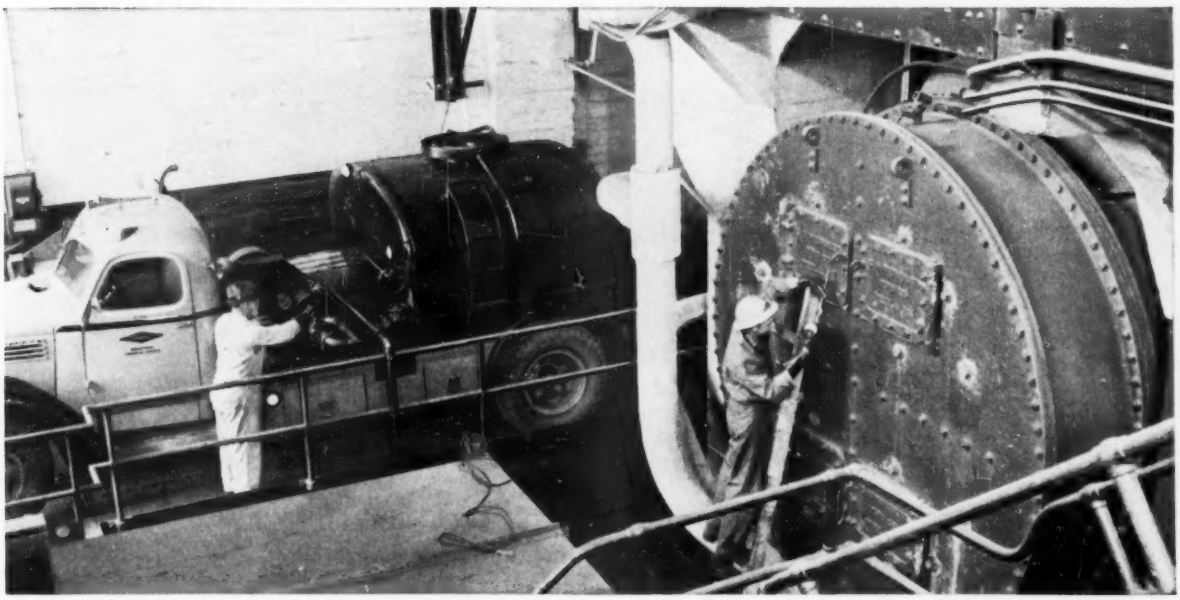
Application Engineer Carl Ritter of Taylor Instrument Co's flew back from Saudi Arabia with some interesting stories. Said one headache power engineers have in the refineries is sand. "Our boys have learned to control movement of **shifting sand dunes,** all right, by dumping oil on them. But fine rock material (less than 1/256th of a millimeter in dia) often remains suspended in atmosphere. When this fine sand collects on working parts of an instrument, for example—you know what happens. Also, the small pebbles (greater than 1 millimeter in dia), that blow about in sandstorms, raise hell. Combine these hazards with variations from 50 to 140 F temperatures in the shade, and you have problems."

Think I'll stick around the U. S. a little longer. Maybe I should see America first, after all.

George Edwards
Engineer

CHEMICAL CLEANING SAVED 400 TONS OF COAL PER YEAR

Fly ash, soot and carbonate deposits removed from condenser by Dowell; vacuum increased



Fly ash and carbonate deposits on the water side of an 800-KW turbo surface condenser had reduced vacuum from a normal 28″ to 24″. The temperature of the water leaving the condenser had dropped from 95°F. to 85°F.

These deposits were removed by Dowell Service with specially prepared liquid solvents. Result: the condenser was restored to its normal operating efficiency. The steam requirement was reduced by 2.5 pounds per kilowatt hour. On the basis of 8,000 hours of yearly operation, the plant engineer calculated a saving of at least 400 tons of coal per year.

Dowell chemical cleaning methods can be used on hundreds of different kinds of industrial equipment. Engineers especially trained for this kind of work do the job for you. They apply solvents according to the technique demanded by the job: filling, spraying, jetting, cascading or vaporizing. Dowell liquid solvents can go wherever steam or water will flow, reaching places inaccessible to other cleaning methods. Scaffolding is unnecessary. Dismantling and downtime are kept to a minimum.

A call for Dowell Service will bring experienced personnel to your plant within a few hours with all necessary chemicals, pump trucks and control equipment. For complete information and estimates on the cleaning of your equipment, contact the nearest Dowell office, or write directly to Tulsa, Dept. G 23.

DOWELL SERVICE

Over 100 Offices to Serve You with Chemical Cleaning for:

Boilers • Condensers • Heat Exchangers • Cooling Systems
Pipe Lines • Piping Systems • Gas Washers • Process Towers
Process Equipment • Evaporators • Filter Beds • Tanks

Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

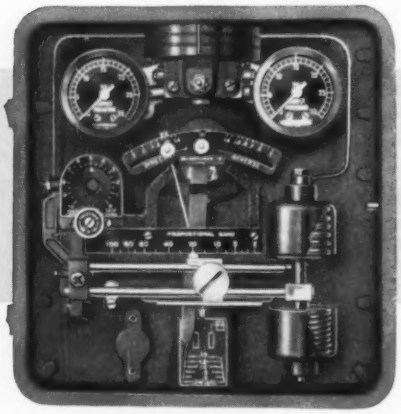
DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

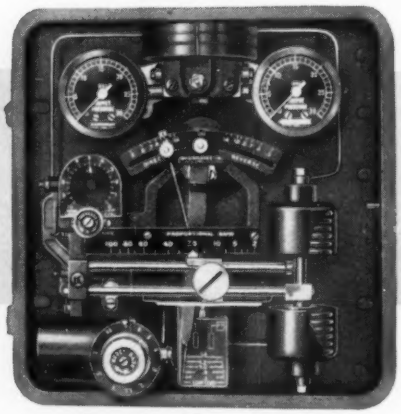
NEW MASONEILAN 12000 SERIES

Offer Accurate, Sensitive,

New Ease of Selection;



Proportional Controller



Proportional-Reset Controller

These new controllers reflect a realistic blending of past experience and current design trends, combining advanced features which reduce weight, improve adjustability and increase ease of selection, installation and servicing.

Consider what these design improvements can mean to you . . .

UNIT CONSTRUCTION

Unit subassemblies of the control mechanisms (proportional, or proportional-reset, unit and level setting mechanism) are mounted on the mechanism bracket which is in turn rigidly attached, piloted and doweled to the torque tube housing. Thus, individual units are fixed in position, unaffected by possible distortion of the case, yet are readily removable for servicing or interchange. Other sub-assemblies (pilot and manifold) are mounted in the rugged aluminum case which is finished and gasketed for outdoor service. Cover is closed by a positive cam-type latch.

SIMPLE AIR CIRCUITS

The high-capacity, balanced, amplifying, pilot with frictionless floating-action valve and cleanable sapphire orifice, is connected to the forged brass manifold which contains most air passages. Tubing in the proportional controller is limited to two short lines. The nozzle is easily removable for cleaning, and after replacement requires no aligning. Special ring type adapters facilitate connections.

EASE OF ADJUSTMENT

Proportional band setting . . . is made on a rod-type cantilever spring by a self-aligning clamp tightened by a large knurled knob located in front of the mechanism. A four-inch direct reading scale indicates the setting.

Control action and specific gravity setting . . . are selected by attaching the control link to desired side of reversing arc along the specific gravity scale, graduated from 0.5 to 1.4. The arc is easily reversible when instrument mounting is changed to opposite side of displacer.

Set point . . . is precisely adjustable throughout entire range by turning setting knob over 270° arc scale, 2″ long. Scale is reversible when control action is changed.

Direct level indication . . . is provided by a sturdy pointer fastened directly to the torque tube rod. The scale is graduated for both left and right hand instrument mounting and for several specific gravities.

FOR FEEDWATER SYSTEMS AND

LIQUID LEVEL CONTROLLERS . . .

Dependable Control – plus

Adjustment and Servicing

Top and bottom connections — integral chamber

Side and bottom (or side and side or side and top) connections — two-piece chamber (to permit field orientation of instrument)

Alignment micrometer . . . is sturdily mounted, is readily accessible and permits adjustments with minimum disturbance.

VERSATILITY

The proportional controller . . . may be used as a *Transmitter* and can be converted in the field to a

Differential gap controller . . . by simply reversing position of the coil spring and bellows in the proportional unit; or

Proportional-reset controller . . . by interchanging the proportional unit and the proportional-reset unit.

STURDY, COMPACT, ACCURATE MEASURING UNIT

All parts of the *Torque Tube Assembly* are made of a single alloy, individual parts being welded to form an integral unit. Knife-edge bearings support both ends of torque tube. Torque tube housing is removable from mechanism chamber.

Stainless . . . steel tubing *Displacers* designed so that standard control mechanism can be used for all ranges, are attached to the torque arm by hangers with modified-knife-edge hooks. Hanger extensions may be integral or detachable.

Chamber . . . assemblies are compact and light in weight to facilitate handling and installation. Mounting dimensions are uniform for all materials and ratings — and are in whole numbers; on side-mounted types mounting dimensions equal level range.

VARIETY OF TYPES, MOUNTINGS, MATERIALS

Instrument Types include *Proportional, Proportional-reset, Differential Gap Controllers* and *Transmitters;* or any combination of two of these in larger case. *Mounting Types* include top and bottom, side and side or side and either top or bottom, with screwed or flanged connections; also top or side of vessel with flanged connections. Instrument mounting left or right of displacer.

Ratings up to 2500 lbs. ASA.

Materials include iron (14″ & 32″ only), steel or alloy chambers; stainless steel displacers; inconel (or wide selection of other materials) torque tube assemblies.

Ranges — 14″, 32″, 48″, 60″, 72″, 84″, 96″, 120″

Complete details sent on request. Address

ALL HIGH Quality Coefficient PRODUCTS

MASON-NEILAN REGULATOR CO.

1186 ADAMS STREET, BOSTON 24, MASS., U. S. A.

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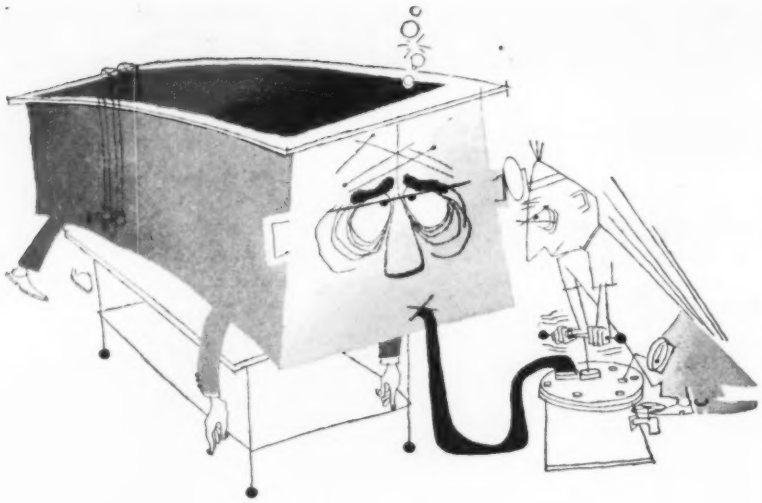
RELATED APPLICATIONS



has **coil-itis*** cramped
your production flow?

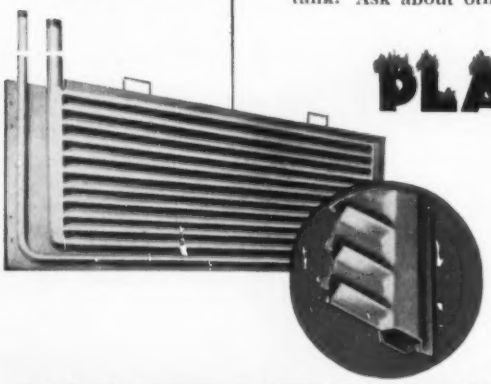
It's a waste of costly time to pump out the solution every time your process heating and cooling tanks get indigestion due to pipe coil troubles. You can save this cost and eliminate production bottlenecks by replacing the pipe coils with Platecoils. Platecoils can be removed and replaced **without dumping the solution**. They simplify maintenance and save hours of downtime. They heat or cool 50% faster and take 50% less space in the tank. As revolutionary as the new wonder drugs, Platecoils cure production troubles involving heat transfer . . . and give profits a shot in the arm.

Write for bulletin P79 today!

PLATECOILS SAVE 50% IN HEAT TRANSFER COSTS

PLATECOILS TRIPLE PRODUCTION

At Continental Motors Corp., 3 crankcase sections can be cleaned at one time when Platecoils are used while only one crank case can be cleaned with pipecoils in the tank. Ask about other case histories.



PLATECOIL

REPLACES PIPE COILS

*

Coil-itis — Diagnosed as tank heating and cooling problems. Platecoils — the prescription for solving pipe coil problems.

PLATECOIL DIVISION, TRANTER MANUFACTURING, Inc., Lansing 4, Michigan

MARMADUKE

Continued from page 144

are made about a thousandth of an inch oversize, and driven into the reamed flange holes on the shafting with an air hammer. And they're driven out the same way.

"Well, we got into the graving dock that afternoon. The next morning we were propped up and dry. The yard mechanics got started building the staging to remove our propeller. That propeller weighed 22,000 pounds. She was a 4-bladed job, and was held on the tapered tail shaft by one large nut and a key.

"The yard gang removed the forty ¾-in. nuts from the protecting cone over the propeller nut. The cone is full of tallow and keeps sea water from seeping into the propeller nut threads and into the hub taper.

"A wire cable was run through the small hole near the tip of one blade. The ends were fastened to pad eyes on either side of the stern, up near the deck. Then a heavy piece of timber was placed as a prop from the dry-dock floor up to the edge of a blade to keep the propeller from turning while removing the large tail-shaft nut. This nut has a left-hand thread, and a large box wrench was placed on the nut to turn against the prop.

"A steam winch was rigged up to take a strain on the wrench while one mechanic jarred it loose with a large sledge.

"After the nut loosened up, the wrench was removed. Then to my utter surprise, those jackasses completely removed the nut. Usually it's only loosened a few threads, but I guess the yard gang figured the steel cable was insurance enough that the propeller wouldn't pop off.

"Inside the shaft alley, two mechanics fitted shoring timber between the stern tube and the nearest shaft flange. That would take the strain off the main thrust block while the propeller was being forced off the shaft.

"Outside, tapered wedges were driven between the propeller's hub and the stern frame. Two huskies pounded away at those wedges—but nothing happened. That propeller wouldn't budge. All morning they pounded away and the sun got hotter and hotter. By noon, everything around the dry dock was red hot. I've seen a lot of stubborn propellers, but that one acted like it was welded to the shaft. Usually a few hefty wallops 'jump' the average propeller—and it really does jump.

"Then the noon whistle blew. 'OK,' barked the yard foreman in charge of the gang, 'to hell with this propeller,

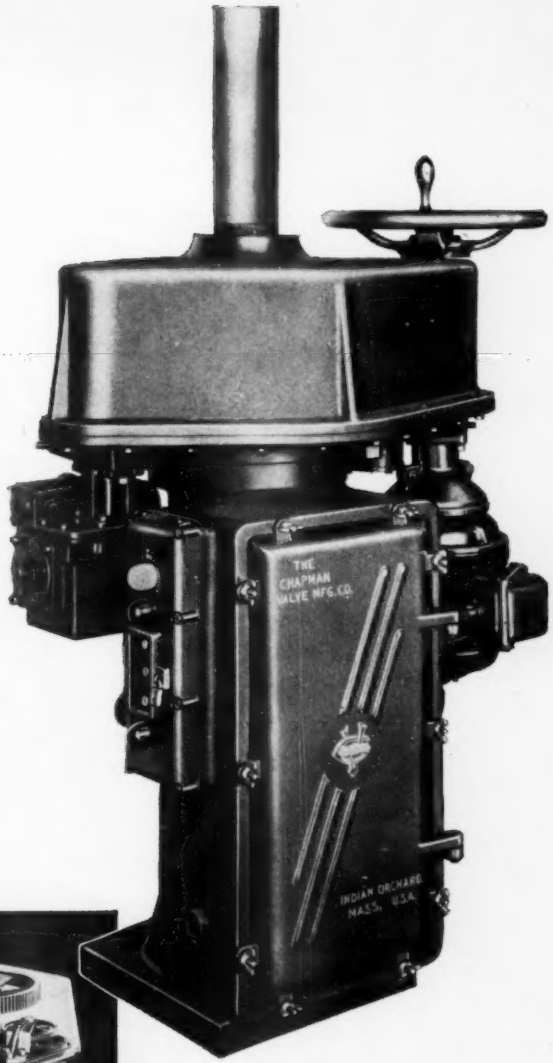
(*Continued on page* 176)

RUGGED BOSS

for Valves, Sluice Gates and Floorstands...

CHAPMAN'S

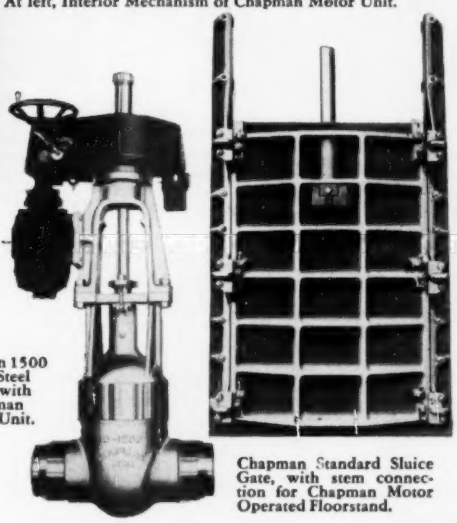
Motor Unit



Above, Floorstand equipped with Chapman Motor Unit, Control Panel, Motor, Limit Switch and Push Button Station all completely wired. At left, Interior Mechanism of Chapman Motor Unit.

For positive control of large valves and sluice gates, the Chapman Motor Unit can safely be given your "power of attorney." The floorstands with Chapman Motor Units come to you with all wiring *complete*, so that all you have to do is bring the power leads into the connection box... which speeds up installation, insures proper operation, and saves wiring costs.

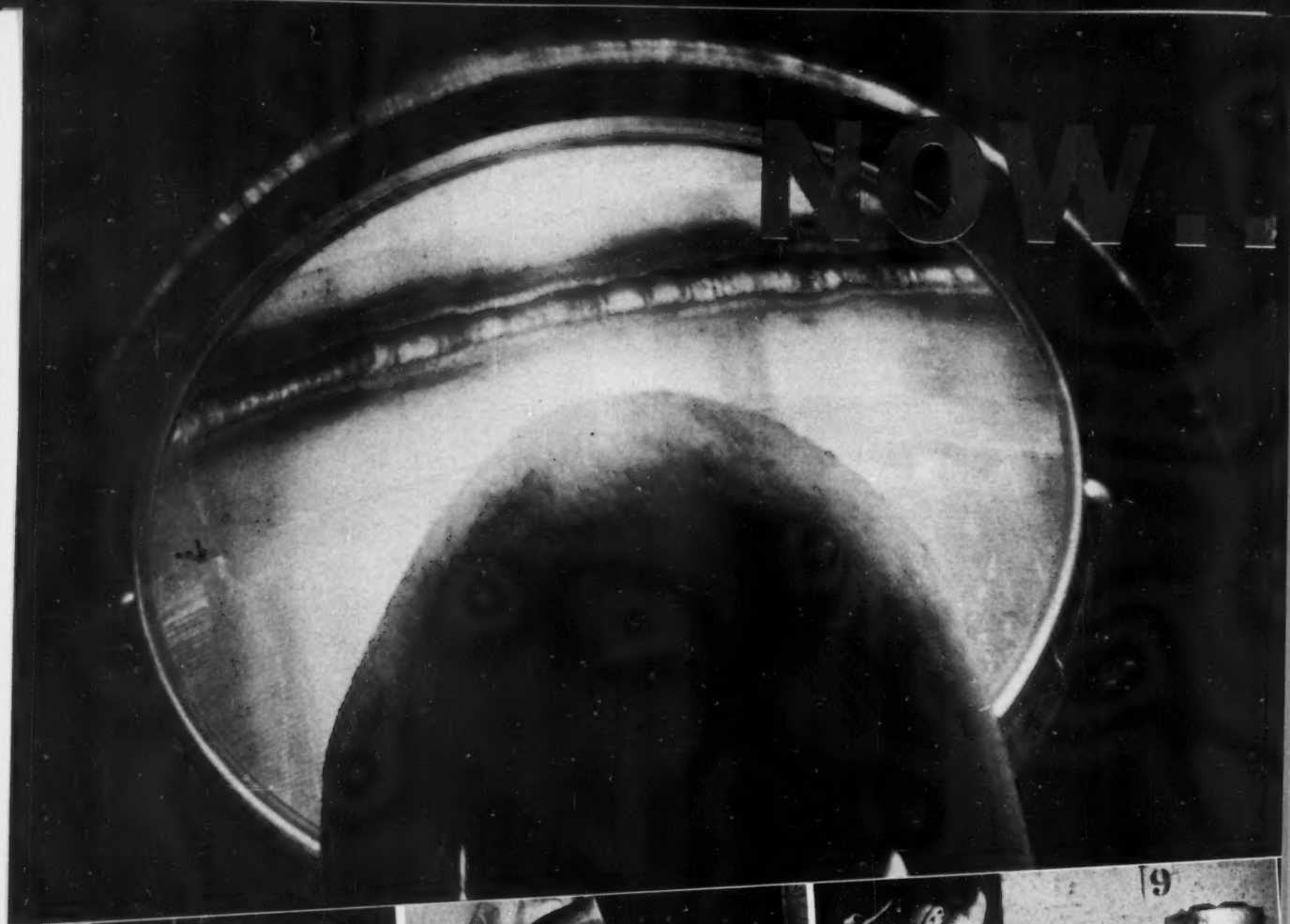
The Chapman Motor Unit is completely housed and thoroughly weatherproof. And the unit itself has the ruggedness of simplicity, with a slow-speed motor driving direct through two trains of spur gears. So there's no drift. The limit switch can be adjusted so the gate or valve closes to the exact seating position. Hand-operated, too, if the need arises. See what this modern electrically driven Motor Unit can do — *and save* — for you. Write for Catalog No. 50.



Chapman 1500 Series Steel Valve, with Chapman Motor Unit.

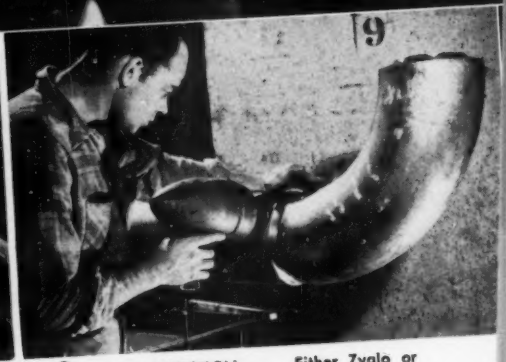
Chapman Standard Sluice Gate, with stem connection for Chapman Motor Operated Floorstand.

The CHAPMAN VALVE Mfg. Company
INDIAN ORCHARD, MASSACHUSETTS, U. S. A.

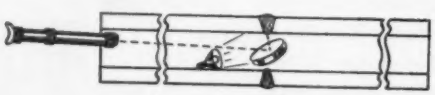


1. THE LINE-UP . . . After precision positioning of butts the joint is tack welded to hold in place during the welding of the initial bead by the K-Weld process. This new technique entails the use of an inert gas under controlled pressure on the inside of the piping.

2. INITIAL BEAD IN K-WELD . . . Only the initial bead is laid by the K-Weld process. It eliminates the need for a backing ring, permits the complete penetration required for critical high-pressure, high-temperature power piping being installed today.



3. FIRST INSPECTION . . . Either Zyglo or X-ray can be used to inspect the K-Weld bead. Elimination of the backing ring removes the stress raising condition at the weld root which can produce flaws either as a result of thermal effects of subsequent weld layers or later severe operating conditions.



Done with mirrors. . . A conventional telescopic bore-sight plus a mirror positioned at the weld permits visual inspection of the K-Weld root. Note smoothness and absence of any icicles which might create local turbulence or break off and damage equipment.

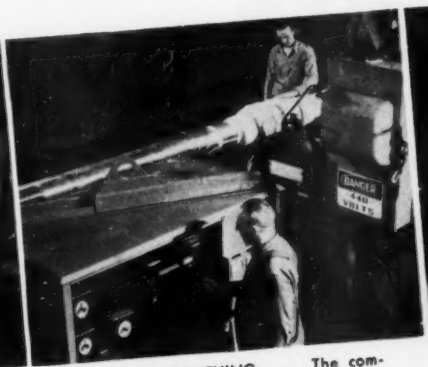
...K-WELD

a picture story of the new welding technique that...

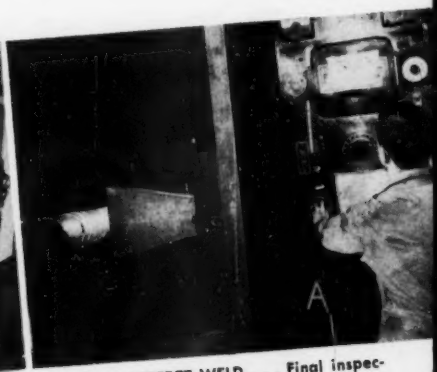
- **assures complete penetration without backing rings**
- **applies to all power piping materials**
- **for use in shop and field fabrication**

From rockets to power piping is largely the story of Kellogg's new K-Weld process, a welding technique that assures a sound root weld in the fabrication of piping. It stems from Kellogg's initial work in the production of thin-wall rockets where shielded-arc welding is a requirement in fabricating stainless steel rocket tubes. How this technique has been developed and extended to the fabrication of critical high-temperature, high-pressure piping is detailed in the accompanying picture story.

4. COMPLETING THE WELD . . . Conventional alloy welding techniques are employed. In using K-Weld there are no added difficulties. Tests prove that any competent operator, after reasonable training, can obtain good penetration using the K-Weld method.



5. STRESS RELIEVING . . . The completed weld after grinding is ready for heat treatment in the customary manner. An additional advantage of K-Weld is that elimination of the backing ring materially aids in the interpretation of radiographs.



6. A PERFECT WELD . . . Final inspection is made of the weld. Here K-Weld has been proved to be extremely useful in eliminating the root cracking associated with austenitic welding . . . providing a completely satisfactory weld.

These leading companies are among the many major producers of power who use M. W. KELLOGG POWER PIPING . . .

- Houilleres Du Bassin Du Nord Et Du Pas-De-Calais (France)
- Hydro-Electric Power Commission of Ontario (Canada)
- Indiana & Michigan Electric Co.
- Interbrabant (Belgium)
- Long Island Lighting Co.
- Metropolitan Edison Co.
- Mexican Light & Power Co. (Mexico)
- Monongahela Power Co.
- New York State Electric & Gas Company

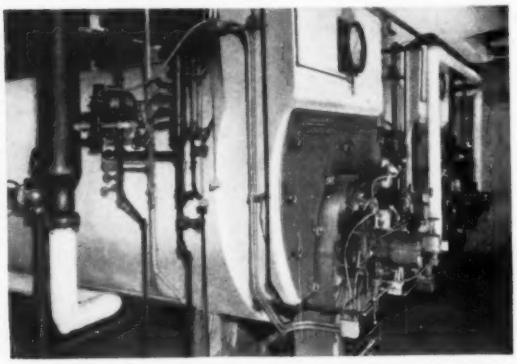
OTHER FABRICATED PRODUCTS including: Pressure Vessels . . . Vacuum Vessels . . . Fractionating Columns . . . Drums and Shells . . . Heat Exchanger . . . Process Piping . . . Bends and Headers . . . Forged and Welded Fittings . . . Concrete and Radial Brick Chimneys

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY

KELLOGG — A SUBSIDIARY OF PULLMAN INCORPORATED

HIGH TEMPERATURE
HIGH PRESSURE
POWER PIPING

MORE ENGINEERING
MORE MATERIAL
MORE EXPERIENCE
MAKE THE DIFFERENCE



KEWANEE BOILERS

KEWANEE
STEEL BOILERS

Wherever Heat or Power or Industrial Process Steam is required there is a Kewanee Boiler just right for the job. And into every Kewanee goes *more of everything* that adds to a boiler's life and makes it most economical. Owners *expect more* from Kewanee Boilers . . . and they *get more.*

Pictured is a battery of two Kewanee Scotch-type Boilers, for low pressure in the boiler room of the Men's Dormitory, Bradley University . . . a Kewanee series which "stands on its own legs," needing no special setting and requiring comparatively little floor space or head room.

Men's Dormitory
BRADLEY UNIVERSITY
Peoria, Illinois
GREGG-BRIGGS & FOLEY
Architects
ASSOCIATED ENGINEERS
Construction Engineers
2 Kewanee Scotch Boilers installed by
PEORIA PIPING & EQUIPMENT CORP.

KEWANEE-ROSS CORPORATION
Division of American Radiator & Standard Sanitary Corporation
KEWANEE, ILLINOIS

Serving home and industry
AMERICAN STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT FORTPOHL · KEWANEE BOILERS · ROSS EXCHANGERS

MARMADUKE

Continued from page 172

boys. Let's get some chow. Maybe she'll loosen up and jump while we're away.'

"'Hold it, McDuff,' I warned the foreman. 'Suppose she does jump as you say—then what?'

"'Then what?' he came back with a screwy look on his face. 'That's exactly what we've been trying to do all morning—get her to jump. And she won't loosen up, Chief,' he added sarcastically. 'Not until we expand that hub with some heat.'

"'In that case, she can jump,' I told him, 'because that job's getting heat right now.'

"'How you figure that?' he asked, giving me that screwy look.

"'Well,' I answered, 'that shaft is 122 feet long. She had a running heat of about 120 degrees when we came into dry dock. Since then she's been cooling off because she's stopped running. But the ship's hull and the propeller were sea-water temperature. That's about 82 degrees, but now the hull is out of the water and everything has been heating up from the sun. And the sun is getting hotter every minute.

"'So that long shaft is shrinking while the hull is expanding. But those wedges against the hub are keeping the shaft from moving on this end. And the main thrust bearing and shoring inside are holding her in place at the other end.

"'Something has to give. I predict that, any time now, that 16-in. shaft is going to snap back through the propeller like a rubber band.'

"'I wouldn't worry about it,' said the foreman. With that he and his gang shoved off towards the Mermaid Lunch Room outside the main gate.

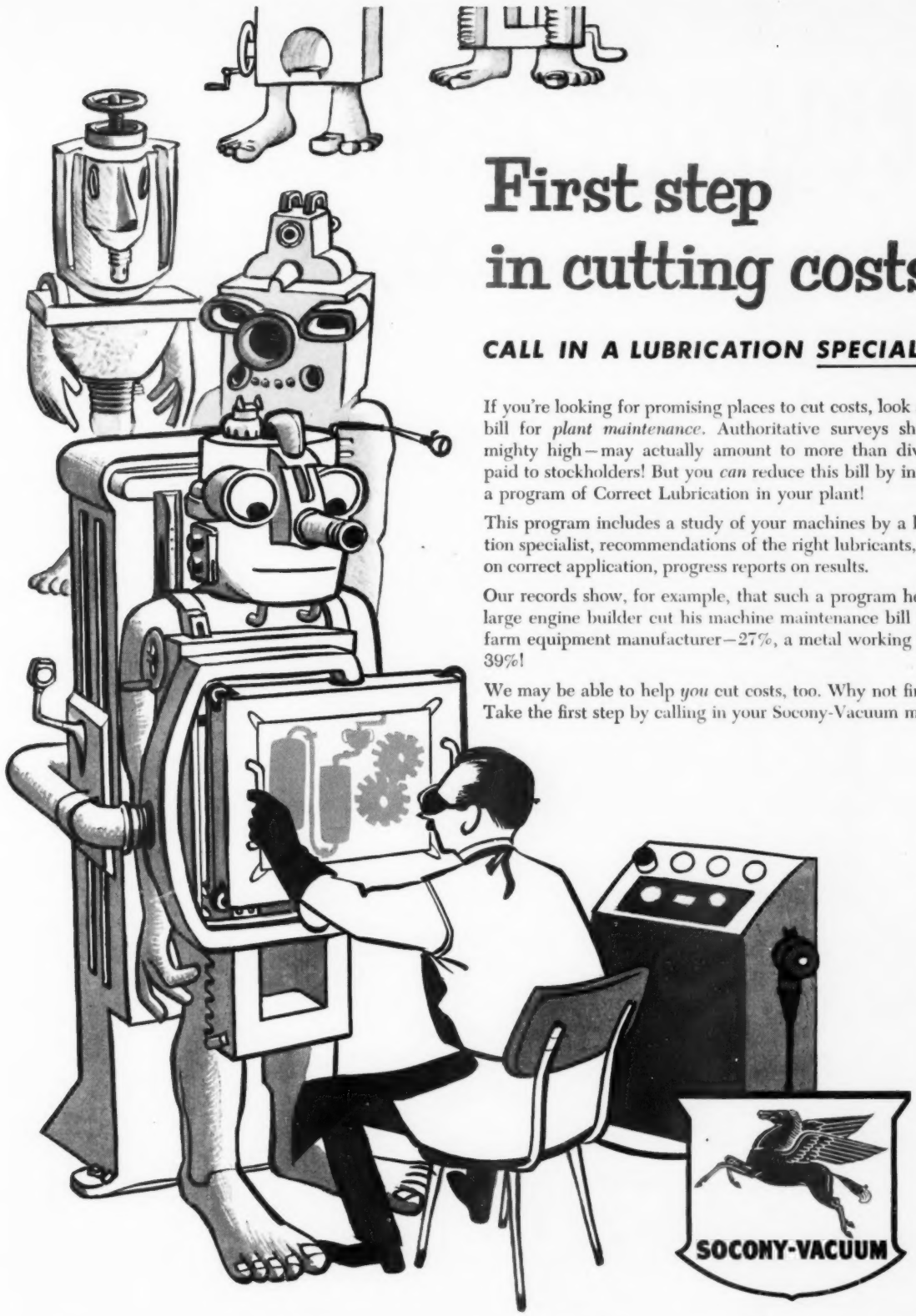
"My first assistant, Joe Betz, from Taunton, Mass., and I followed them. We wanted a shoreside meal for a change that we could wash down with some beer.

"About the time we put away a couple of dozen clams and killed a few bottles, there came a loud report from the graving dock. It sounded like a cannon shot that had smacked an iron fort.

"Joe Betz and I made knots for our ship. Everyone else was taking off in the same direction. When we got there, a big crowd of yard men and some office help were down in the graving dock looking at the propeller. And the foreman was breaking all records climbing up the scaffold. I climbed up after him. Then the foreman started cussing a blue streak. One good look, and I saw what he was raving about.

"The propeller had loosened all right—exactly as he hoped it would. Only it let go like an 11-ton shot. It hit the stern

(*Continued on page* 180)



First step in cutting costs...

CALL IN A LUBRICATION SPECIALIST!

If you're looking for promising places to cut costs, look at your bill for *plant maintenance*. Authoritative surveys show it's mighty high—may actually amount to more than dividends paid to stockholders! But you *can* reduce this bill by installing a program of Correct Lubrication in your plant!

This program includes a study of your machines by a lubrication specialist, recommendations of the right lubricants, advice on correct application, progress reports on results.

Our records show, for example, that such a program helped a large engine builder cut his machine maintenance bill 24%, a farm equipment manufacturer—27%, a metal working plant—39%!

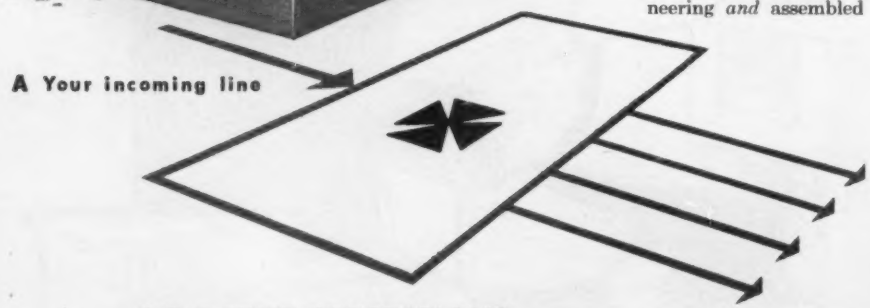
We may be able to help *you* cut costs, too. Why not find out? Take the first step by calling in your Socony-Vacuum man!

Socony-Vacuum *Correct Lubrication*

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

COMPLETE ENGINEERING *costs less!*

You provide the requirements. I-T-E provides the complete engineering *and* assembled equipment.



I-T-E UNIT SUBSTATIONS

are available in all required ratings, indoor or outdoor, for every service condition. Substations include primary air circuit breakers or interrupter switches, transformers (oil-filled, askarel-filled, air-cooled, or nitrogen-sealed), and secondary air switchgear.

I-T-E Unit Substations for modern plant distribution

Modern plants require the utmost in power distribution efficiency, reliable circuit protection, service continuity, safety, and economy.

Unit Substations—integrated units of stepdown transformers and protective switchgear for location at load centers—have been an I-T-E specialty for many years.

Over-all responsibility

From the incoming lines to the outgoing circuits, I-T-E supplies all the equipment you need—completely coordinated as a package. Furthermore, I-T-E assumes full responsibility—from initial planning, through manufacture, to shipment. Factory-assembled and -tested, *complete* unit substations are delivered ready for installation.

Quality throughout

I-T-E's experienced staff of switchgear engineers assures you professional competence in the selection and application of all components to fit each job. The proved quality of I-T-E products is your guarantee of uniform, outstanding performance, long life, and over-all economy.

See how much I-T-E COORDINATED PLANNING can save you!

There is an I-T-E Application Engineer near you. He will assist you with your specific requirements—and show you how you can save with *complete* I-T-E engineering. Give him a call. *I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.*

I-T-E

UNIT SUBSTATIONS
for every application

an ACCO product

1 Stainless steel bolts and nuts. 2 Two-piece gland and follower.
3 Bolted bonnet. 4 Tongue and groove joint.
5 Hardened wedge, chrome plated.

Why Gas Absorption Plant Chose These R-P&C Valves

● Because of the plant's isolated location the engineers felt they should standardize on a type of valve which could be used on different lines even though chemical solutions, temperatures, and pressures varied. The No. 6056 R-P&C Forged Steel Gate Valve proved to be the answer for several reasons.

First of all it has a pressure range from 380 lbs. at 1000° F., up to 2000 lbs. at 100° F. Then with its chrome stainless trim and chromium plated disc, it has high resistance to corrosion. On top of this, it's easy to service with its stainless steel gland bolts, and two-piece gland and follower.

Best of all, although the R-P&C Forged Steel Valve is premium quality it is NOT premium priced. It comes in sizes from ¼" to 2" with screwed or welding ends. If you use valves in these sizes, see your R-P&C distributor today or write our Reading, Pa., office for literature.

ACCO
R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE
Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.
TRADE MARK

R-P&C valves

MARMADUKE

Continued from page 176

post with such a crash that the post evidently bent out like a bow and sent that propeller the hell back where it came from. Only this time the propeller rested a good inch further up on the taper than it had before. And if she hadn't swung from that steel cable, she would have crashed to the dry dock.

"Removing that propeller this time was another story," wound up Marmaduke. "So take my advice. Any time you heave the anchor on machinery, you're giving it a chance to shove off. Be mighty sure you stand by to keep it under control.

"In this case," roared Marmaduke, turning back to his desk, "All the yard foreman had to do was ease the nut off a few threads, instead of removing it all the way."

PROPORTIONING PUMP

Continued from page 117

pump speed in proportion to fluid flow through line. With a 25-psi power source, chemicals are discharged at about 100 psi; with a 100-psi source, discharge is at about 900 psi. Capacities range from 0.1 to 0.23 gpm at 120 strokes per min.

Power-Driven Unit. The motor-drjven variable-stroke pump, Fig. 5, has a free-floating plunger *P*, ranging in diameter from ¼ to 1 in. with stroke adjustable from 0 to 2 in. It runs at speeds up to 60 strokes per minute, pressures to 4000 psi.

Pump has a cylindrical crosshead *C*, driven by a connecting rod and constant-throw crank. Stroke adjustment is made by sleeve *S*, threaded into the crosshead and onto drive-rod *D*. Screwing the sleeve into or out of crosshead decreases or increases length of plunger's stroke by changing the lost motion at *A* between drive rod and sleeve heads.

Thrust from connecting rod to crosshead is taken by a ball-bearing roller riding on a track not shown. Crank turns clockwise so connecting-rod power thrust is downward on this bearing during each discharge stroke. This leaves crosshead free so stroke length can be adjusted while pump runs.

Pump without motor drive may be installed as a linkage-driven unit. Installation is made by connecting pump's drive rod direct to the crosshead arm of a reciprocating pump, or to any machine having a reciprocating or oscillating movement.

Adjustable-Stroke Unit. Fig. 6 is a cross section through a motor-driven pump whose stroke is adjusted at its

NEW Standards

IN SPEED and SIMPLICITY OF COAL UNLOADING

This Mead-Morrison Unloader was purchased for a free digging rate of 600 tons per hour . . . but it is regularly handling more than 700 tons of coal per hour from barge to hopper, and the design is equally effective in handling ore or limestone.

The machine excels in simplicity as well as in capacity. It provides an ease and smoothness of grab bucket control . . . both in free digging and in barge clean-up operations . . . never before obtainable in a machine operating on alternating current.

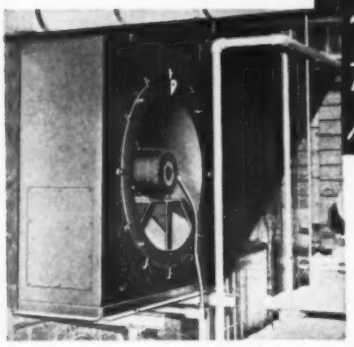
When planning new unloading equipment, let our engineers send you full information on the distinctive Mead-Morrison features that can increase the speed and improve the efficiency of your ore, limestone and coal unloading.

MEAD-MORRISON

Division of McKIERNAN-TERRY CORPORATION • *Manufacturing Engineers*

HARRISON, NEW JERSEY

Announcing
The WING Package—
DRAFT INDUCER
FOR POWER PLANTS

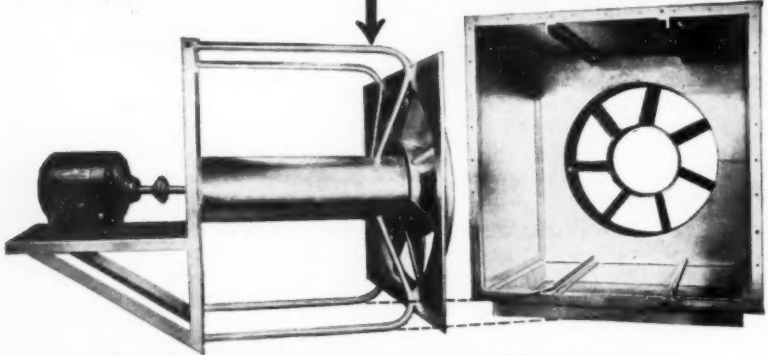


Motor (or Turbine) and Fan in one complete removable unit

In this new high-pressure "Package" Draft Inducer, the motor (or turbine) and fan unit, completely independent of the casing, makes installation considerably easier, and being easily removed, facilitates inspection and maintenance.

ADVANTAGES

1. Big saving in space requirements
2. Compactness permits fewer and lighter structural supports
3. Eliminates field line-up problems
4. Eliminates water cooling
5. Only two supporting bearings
6. Wide flexibility in gas inlets
7. All moving parts quickly and easily accessible
8. Saves on investment and maintenance
9. Low load ratings on natural draft because of Wingfoil Fan and ample free gas travel area



Wing Package Draft Inducers are available in many sizes with either turbine or electric motor drive. For further information write

Wing

L. J. Wing Mfg. Co.
50 Vreeland Mills Road,
Linden, New Jersey
FACTORIES: Linden, N.J. and Montreal, Can.

PROPORTIONING PUMP

Continued from page 180

driving crank *K*. Crankpin *C* is in a block movable by a screw in slot *S*. In position shown, pin *C* is at outer end of crank, giving plunger *P* maximum stroke and the pump maximum discharge. If crankpin is moved down until it centers on drive shaft, its throw is zero, as is pump discharge. So by positioning the crankpin, pump discharge is adjustable over its full range. Most pumps of this type have a scale on crank to show capacity at different crankpin settings.

This pump has double-ball suction and discharge valves. Should solid matter lodge under one ball, chances are good the other will hold and give positive valve action. Pump must be stopped before discharge is adjusted. For many applications, flow need not be changed often once it is set.

Rhodesia Plans 2-Stage Hydro Development

Northern Rhodesia will build an $84 million hydroelectric development on the Kafue Gorge.

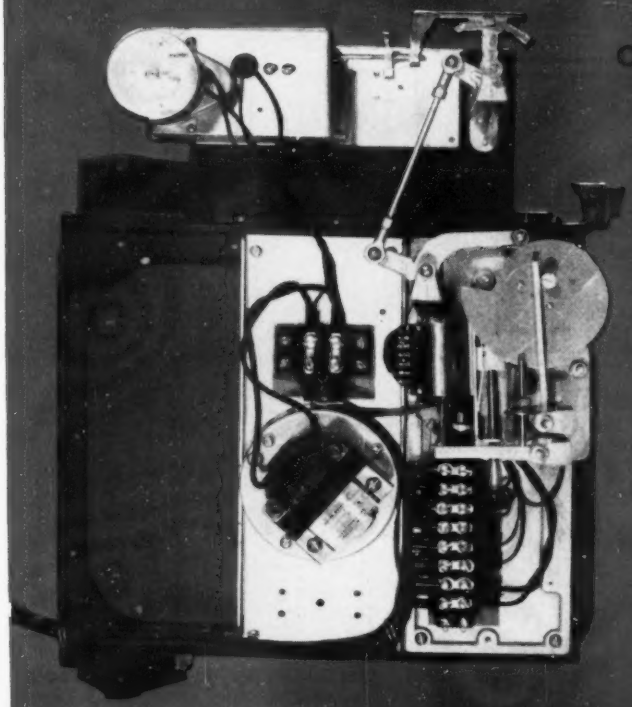
Tapping vast copper and other mineral wealth in Northern and Southern Rhodesia requires an immediate start on this important hydro project, the first of two proposed during the next twenty years. The gorge is on the Kafue River near its exit into the Zambezi, about 350 miles below world-famous Victoria Falls.

A diversion dam 600 ft long and 100 ft high will be thrown across the Kafue Gorge to form a reservoir. From there, two 13.5-mile tunnels having a total flow of 2500 cfs will drop to a 500,000-hp powerhouse developing a 1900 ft head. The project will require transporting nearly 250,000 tons of material and equipment to a site difficult to reach and will take nearly 7 years to complete.

The Kariba Gorge, on the Zambezi River about 50 miles from the Kafue site, can develop 1,500,000 hp plus large storage capacity. This project is estimated to cost $210 million and will include fourteen 115,000 hp units. The two projects, when completed, will insure ample cheap power to Northern and Southern Rhodesia industries for many years to come.

Bonneville Dam powerhouse on the Columbia River established a new production record during March with generators turning out 424,547,000 kwh in 31 days. Average hourly output was 570,628 kw. The 10 generators have namplate rating of 518,000 kw and maximum load capacity is 574,000 kw.

a new electronic flow meter!



Choice of 3 mercury-less transmitters

Hays Barton flow or differential transmitter

Hays differential transmitter

Hays liquid level transmitter

continuous integration —no creep at zero

unaffected by normal voltage, frequency and temperature changes

electronic operation provides high speed and greater accuracy

3 to 1 range calibration at recorder

HAYS Electronic Flow Meter

Since the circuit is of the electronic null-balance type, it is unaffected by normal voltage and frequency variations. Also, neither temperature variations nor reasonable length of transmission lines affect the calibration of the instrument.

The *pen-drive motor* is built for reversing duty. Normal variations in voltage and frequency have no noticeable effect on its operation.

The *integrator* is continuous in operation and simple in mechanical construction. A micrometer zero adjustment for calibration is easily accessible.

Indicators can be calibrated to read directly in rate-of-flow or other factors as desired.

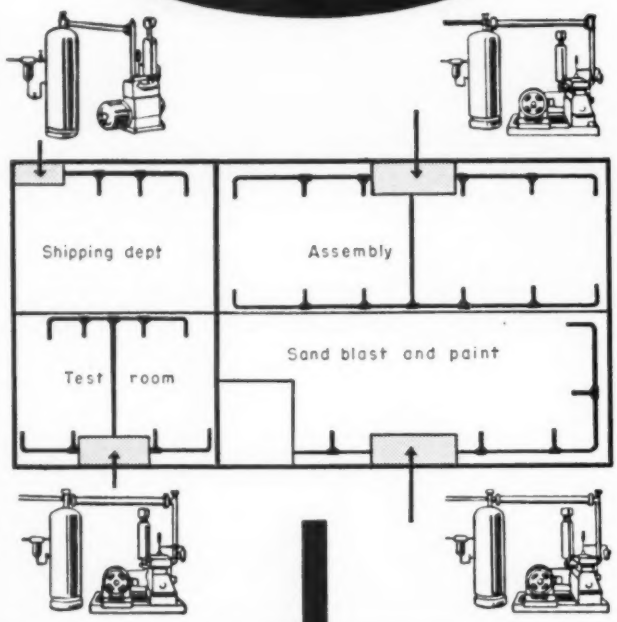
Write today for full information on the Hays Electronic Flow Meter Bulletin 52-1074-222.

Automatic Combustion Control
Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

THE hays CORPORATION

MICHIGAN CITY 3, INDIANA

How To SAVE MONEY



on your AIR COMPRESSOR Installation

with the SCHRAMM UNIT SYSTEM

The perfect, money-saving, "inside-the-plant" air compressor installation is the Schramm unit system . . . whereby, in a minimum of space, you install one, two, three or more Schramm air compressors, according to your air needs, and operate them separately, or as one unit, as the load requires.

1. Low in initial cost. No foundation cost, cuts by half the installation price. Can be transported into the plant on standard material handling equipment, set in place, grouted, bolted down, ready for use immediately.

2. Low in operating cost. The losses when operating a large compressor at light load are very great. On the other hand, the vertical compressors in unit system can be equipped with automatic start and stop control, set at proper pressure ranges, so as to regulate the air output according to load demand. Unit system installations allow you to use one, or as many of the compressors as you need.

SCHRAMM INC.

The Compressor People

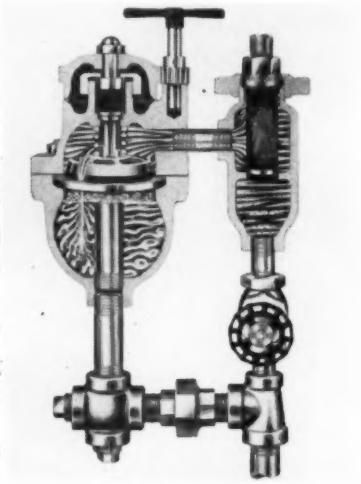
WEST CHESTER PENNSYLVANIA

More EQUIPMENT NEWS

Begins on page 156

of the manometric type, with automatic temperature compensation. They are approved for use under the new ruling of the ASME boiler code committee, as covered in code case 1155.

Yarnall-Waring Co, Chestnut Hill, Philadelphia 18, Pa.



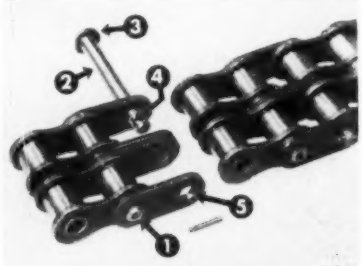
Orifice Meter

709 • New orifice meter is designed to provide continuous boiler blow-off without excessive heat waste, manufacturer claims. Unit is connected at the surface and continuously drains water from what is said to be the area of greatest concentration of impurities.

Orifice plate with 17 calibrated orifices permits selection of proper opening for any operating condition. Orifices are guaranteed for 10 years against wire drawing, cutting or other distortion.

Madden Corp, 1543 Morse Ave, Chicago 26, Ill.

For more data on these items, use post cards p. 165. Identify your request with item number.



Riveted Roller Chain

751 • Improved riveted roller chain is supplied in ASA standard and heavy series, 1 in. through 2½ in. pitch sizes, in multiple widths. It features exclusive single-pin coupler.

One end of coupler link is riveted to adjacent link. Other end contains the coupler pin. One end of pin is spun over

Highly specialized process controls are used to produce the finest in seamless WELDING FITTINGS

Only Globe, among manufacturers of welding fittings, produces its own seamless steel tubes. Specialized processes at every stage of manufacture from billet to tube — to fitting — insure uniform high quality. Thorough inspection and continuous laboratory control guarantee strict conformity to rigid specifications.

Now . . . you can get these high-quality fittings when you need them — in the quantities you want. Just get in touch with your nearest Globe distributor.

GLOBE STEEL TUBES CO., Milwaukee 46, Wisconsin
Chicago • Cleveland • Detroit • New York • Philadelphia • St. Louis
Denver • Houston • San Francisco • Glendale, Cal.

Producers of Globe Welding Fittings — Globe seamless stainless steel tubes — alloy — carbon seamless steel tubes — Gloweld welded stainless steel tubes — Globeiron (high purity ingot iron) seamless tubes.

AVAILABLE IN A COMPLETE LINE OF SIZES AND WEIGHTS THROUGH GLOBE DISTRIBUTORS IN ALL KEY CITIES

Here is one of the highly specialized manufacturing operations that insure Globe quality — piercing the billet to form a seamless tube.

Send for the Globe Welding Fittings catalog.

NOW! LATTICE BRAID* PACKING WITH TEFLON†

Heavy Teflon impregnation throughout
Choice of Canadian white asbestos or blue African asbestos
Unique LATTICE BRAID construction

An Exclusive GARLOCK Shaft and Rod Packing

LATTICE BRAID packing (a patented Garlock product) is braided through and through to give it strength, flexibility, resiliency, and long life. Teflon (a du Pont product) is unaffected by caustics, process liquids, solvents, acids or chemicals of any kind.

Garlock combines these two products by impregnating each strand of LATTICE BRAID asbestos packing with Teflon suspensoid. The result is a sturdy braided asbestos packing with a heavy, thoroughly distributed Teflon impregnation which is unaffected by the liquid being handled. This long-life packing has a low coefficient of friction, is non-corrosive and non-contaminating.

LATTICE BRAID with Teflon is available in either Canadian white asbestos (Style 5861) or blue African asbestos (Style 5880). Garlock also manufactures all-Teflon LATTICE BRAID packing, plastic packings of shredded Teflon, and other Teflon products.

For complete information, write us or contact your Garlock representative.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.
Branch Offices in Most Principal Cities

*REGISTERED TRADEMARK
†The Du Pont Company's Trademark

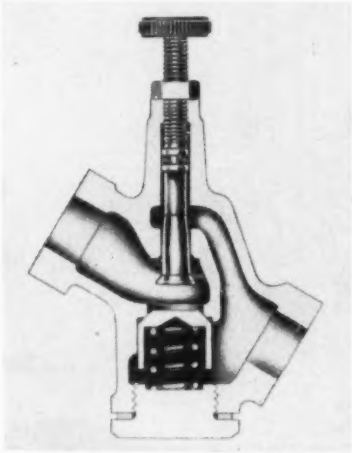
GARLOCK
PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS

More EQUIPMENT NEWS

Begins on apage 156

washer, other has milled flat and locking pin hole. Pin is an easy fit, except for the milled flat end which is press-fitted into coupler link plate. Chain is boxed in 10-ft lengths, and any even-pitch length from 2 pitches up to 10 ft can be made from one box.

Baldwin-Duckworth, Div of Chain Belt Co, Springfield 2, Mass.



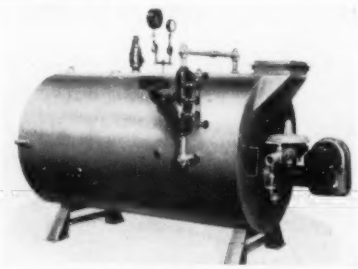
Speed Control Valve

729 • New valve provides split-second timing of piston movement by positive control of air flow, manufacturer claims. Only moving part is the poppet, and valve can be mounted in any position between the operating valve and one or both ends of a cylinder to provide air flow adjustment.

Valve can be disassembled without breaking the line connection. Available with ¼ to 1¼ in. internal pipe thread.

Ross Operating Valve Co, 120 E Golden Gate, Detroit 3, Mich.

For more data on these items, use post cards p. 165. Identify your request with item number.



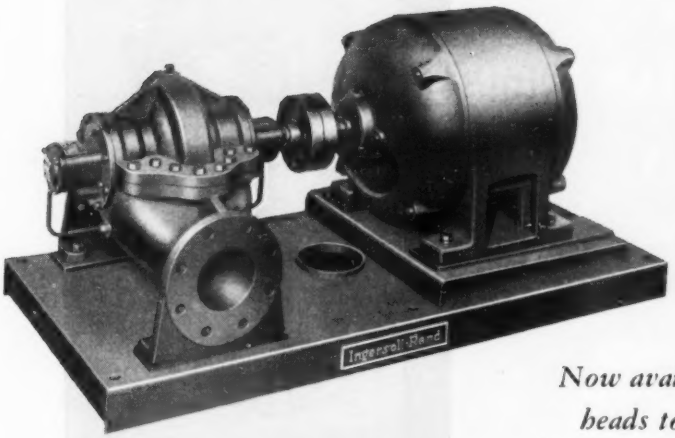
Marine-Type Boiler

752 • *Supermarine Model LO* boiler burns either oil or gas, is the internally-fired, two-pass type. Fan supplies all combustion air whether fuel is gas or oil. Spark ignition is automatic on either fuel and there is no pilot. If there is either flame or electric failure, electronic safety controls shut off burner instantly.

Sellers Engineering Co, 4876 N Clark St, Chicago, Ill.

(*Continued on page* 188)

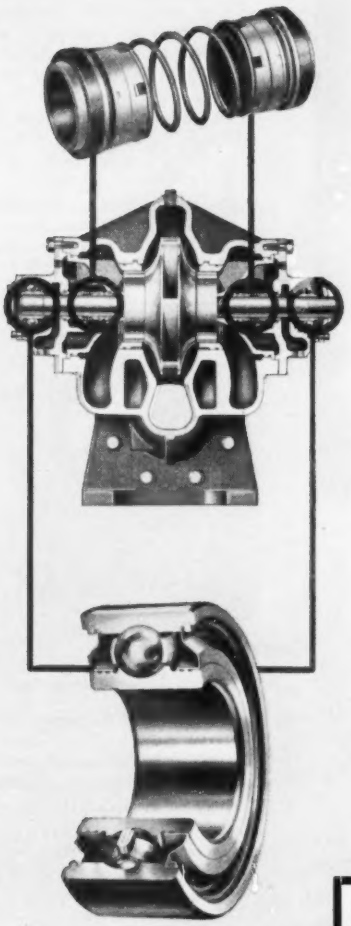
ELIMINATE MAINTENANCE PROBLEMS



with
Ingersoll-Rand

DMV
PUMPS

Now available for general hydraulic service heads to 300 ft.—capacities to 1900 gpm



NO STUFFING BOX ATTENTION

There are no packed stuffing boxes in the new DMV pumps. No periodic adjustment—no repacking—no annoying leaks. Double Mechanical Shaft Seals are *standard equipment* with water pumps. These performance-proved mechanical seals are self-adjusting—require no attention for the entire service life of their sealing faces. Replacement, when needed, is greatly simplified by easily accessible seal-box extensions. Double seals give better pump performance under suction lift, too—and last longer on gritty-liquid service.

NO BEARING LUBRICATION

Greasing or oiling of pump bearings is a thing of the past. The DMV uses modern, cartridge-type ball bearings with the lubricant *permanently sealed in.* Sealed bearings of this same type have operated successfully and without attention for periods of more than 11 years in tough service!

Now you can put an end to the care and nursing of outdated pumps. The DMV line gives you a pump that can be installed anywhere with complete confidence. Maintenance requirements are practically zero. And the simple, accessible design saves on spare parts inventory—cuts costly down-time.

Call your nearest I-R branch office for the full story. Or write for Bulletin 7248.

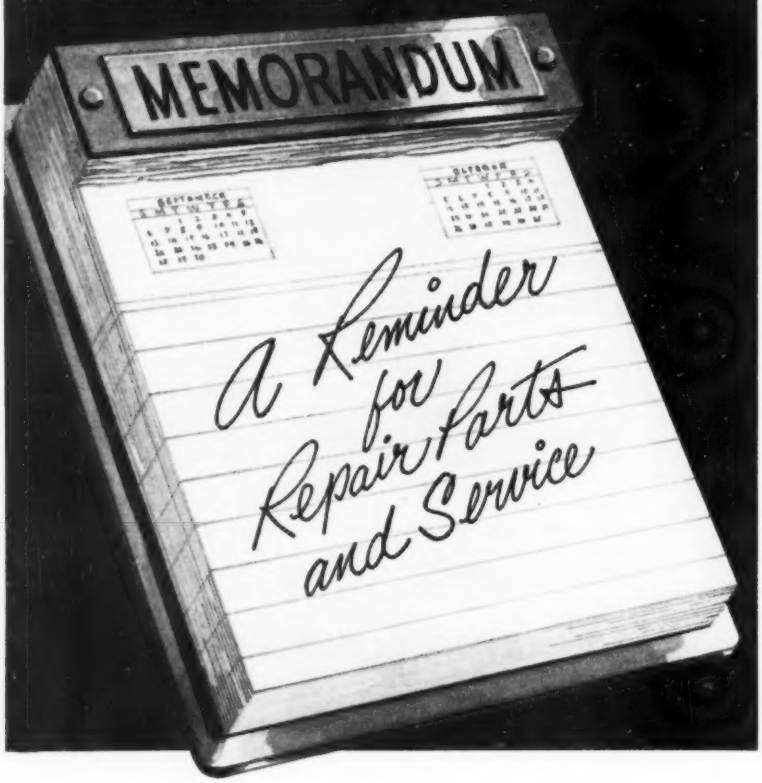
888-10

Ingersoll-Rand
Cameron Pump Division
11 Broadway, New York 4, N. Y.

COMPRESSORS • GAS & DIESEL ENGINES • AIR & ELECTRIC TOOLS • ROCK DRILLS • VACUUM EQUIPMENT • TURBO-BLOWERS

TO OWNERS OF...

- AMES STEAM ENGINES
- ELLIOTT (Ridgway) STEAM ENGINES
- CHUSE STEAM ENGINES



By individual arrangements with the manufacturers of the discontinued Ames, Elliott (Ridgway), and Chuse Steam Engines, Skinner Engine Company has been made the exclusive supplier of parts and service for their engines.

Owners are assured of the same prompt attention and expert service extended to owners of Skinner Steam Engines. Requests for inspection, parts, or service should be addressed to:

SKINNER ENGINE COMPANY
Service Department
ERIE, PENNSYLVANIA
Telephone: Erie 2-3661

For Over 80 Years, Doing One Thing Well—Building Steam Engines
SKINNER ENGINE COMPANY, ERIE, PA.

More EQUIPMENT NEWS

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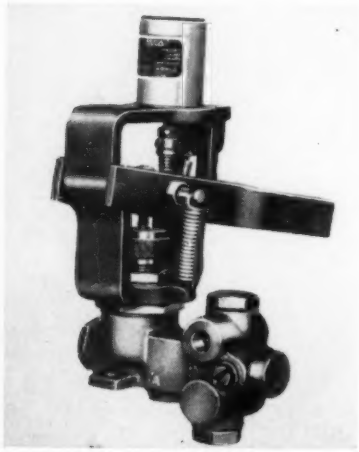


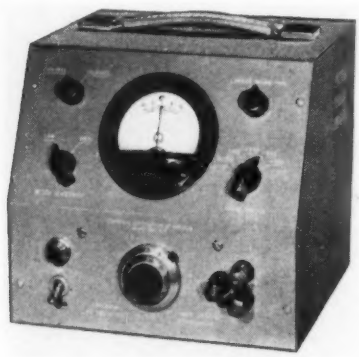
Pressure-Operated Valve

733 • Pressure-operated manually reset valve is designed for hazardous locations where electrical connections are undesirable. Unit operates on loss or application of pressure, is available in two, three or four-way construction.

Sizes range from ⅜ to 6 in. for the two-way valve, ¼ to ½ in. for three-way unit, ¼ to ¾ in. for four-way type. Bulletin 8035.

Automatic Switch Co, Orange, N.J.

For more data on these items, use post cards p. 165. Identify your request with item number.



Dc Voltmeter

710 • Laboratory standard dc voltmeter, model PVM-4, is said to feature resolution better than 50 mv over the entire range of 0 to 600 v. Accuracy is better than 0.2%, linearity better than 0.1%, input impedance infinite.

Unit consists of a power supply, attenuator and null indicator. It is particularly suited to testing power supply regulation, meter calibration, etc. Bulletin available.

Computer Corp of America, 149 Church St, New York 7, N. Y.

Drafting Templates

739 • *Engravograph* cuts templates of often-repeated elements to the individual

*Could you make this report about your diesel engine?**

CITY OF BESSEMER, MICHIGAN REPORTS:

Nordberg Diesel engine used by Bessemer, Michigan Municipal Power Plant.

PISTONS PULLED AT 24,600 HOURS!

- All rings were free
- No carbon in ring grooves
- All original rings replaced in original grooves
- Rings should last at least 10,000 more hours
- Maximum cylinder wear was .004 at top, .002 at bottom

OIL CHANGE AT 5000 HOURS!

- No oil added to crankcase between changes
- Power cylinders fed at rate of 5 drops per minute
- Main bearing, rod bearings show very little wear
- Average K.W. per gallon of fuel is 13.5 @ 60% load factor

EXCELLENT

Sam Kalember

Superintendent,
Bessemer Light Utility.

Note:

FOR TOP ENGINE EFFICIENCY, BESSEMER RELIES ON:

Cities Service DC-930 Oil used for crankcase lubrication!

Cities Service DC-230 Oil used for power cylinder lubrication!

* Why not contact your nearest Cities Service Representative or write Cities Service Oil Company, Dept. G16, Sixty Wall Tower, New York City 5, New York.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

You'll SAVE Muscles and Money with Darts!

This True Ball Joint Makes the Difference

Dart seats are wider and spherically ground to a true ball joint. You get a *drop-tight* joint without excessive wrenching. Yes, and you can use Darts over and over again to cut your costs!

QUICK FACTS

- 2 BRONZE SEATS resist pitting and corrosion — stay serviceable year after year
- HEAVY SHOULDERS built to take severe wrenching
- NUT AND BODY of practically indestructible, air-refined, high test malleable iron
- THREADS full, clean-cut and hard. They won't deform or strip

Be sure to say "Darts" to your supplier. They'll save you money and maintenance headaches over the years.

DART UNION COMPANY
Providence 5, Rhode Island
The Fairbanks Co. — Distributors
Boston • New York • Pittsburgh • Rome, Ga.

DART
UNIONS

More EQUIPMENT NEWS

Begins on page 156

draftsman's needs. Master design is reproduced by rotating engraving cutter guided by pantograph, duplicating the original on transparent plastic. Cutter can be shaped so image has beveled edges conforming to angle of the pencil point.

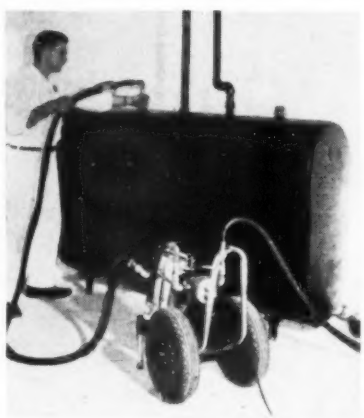
New Hermes Engraving Machine Corp, 13-19 University Place, New York 3, N. Y.

Welding Transformer

754 • New 400-amp single-phase ac welding transformer has 60% duty cycle. Type WK40K welder has current range of 40 to 500 amps, incorporates arc-stabilizing capacitors that make it easier for operators to strike and maintain arc without pop-outs, manufacturer claims. Unit is 44 in. high, weighs 355 lbs.

General Electric Co, Schenectady 5, N. Y.

For more data on these items, use post cards p. 165. Identify your request with item number.



Tank Cleaner

733 • Apparatus removes sludge, dirt, water and other impurities from liquid storage tanks, and can be applied to almost any type tank and to almost all liquids. Portable unit operates like a vacuum cleaner, using a rotary pump as its heart. Manufacturer recommends the unit for

NO GETTING AROUND IT!

CONTINUOUS Purification Is Continuous PROTECTION

To give your power unit maximum protection, purify the lubricating oil ***continuously***. Even a De Laval machine gives most effective results when it is operated on continuous by-pass rather than on "batch."

This is so because the action of the centrifuge is itself continuous — the machine constantly discharges clean dry oil and sends the removed water to waste. Any leakage of water to the lubrication system shows up at once. There is no chance for any dangerous amount of condensate or other water to collect in the oil.

A De Laval Oil Purifier of proper size will clean all the oil in the system every six to eight hours. The exact rate of purification depends on the viscosity of the oil and the size and character of the contaminants. No getting around it, continuous purification provides continuous ***protection.***

THE DE LAVAL SEPARATOR COMPANY • Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL

OIL PURIFIERS

FOR MORE DEPENDABLE POWER PRODUCTION

Weber's Super Insulating Cement

APPLIES

easier—super adhesion!
faster—super fine mix!
further—super coverage!

FINISHES

much smoother—much whiter.

INSULATES

better—lower K factor; higher heat resistance.
longer—physically stable; chemically neutral.
at higher temperatures—up to 2100° F.

FORTY-EIGHT INSULATIONS, INC.
AURORA, ILLINOIS

Send me full details on Weber's Super "48" Insulating Cement—and a sample to try.

NAME_____
TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____

More EQUIPMENT NEWS

Begins on page 156

cleaning fuel oil tanks to help prevent oil burner breakdowns from clogged controls, etc.

Visa-Clean Corp, Randallstown, Md.

For more data on these items, use post cards p. 165. Identify your request with item number.

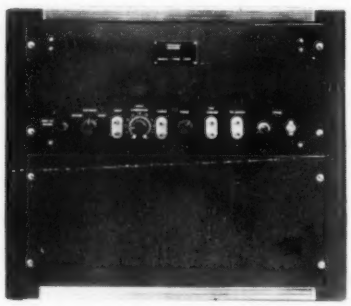
Standard Control Panel

703 • Control panel for automatic heating and power equipment is said to guarantee proper mounting and wiring for commercial and industrial controls, regardless of the fuel used.

Panels are supplied in standard assemblies for the most frequently used types of controls, and in custom-made assemblies for special needs. 230-v, 60-cycle current is standard. All controls, switches, instruments and gages are mounted, wired and tested at the factory. A terminal strip is provided for field connections of the external wires from panel to burner-mounted controls.

Dimensions of the panel are approximately 36 x 28 x 5¾ in.

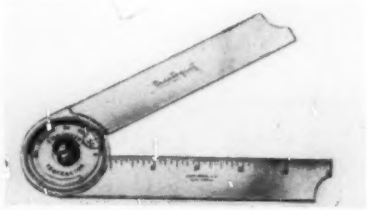
Iron Fireman Mfg Co, Cleveland 11, Ohio.



Transient Recorder

713 • Type 103 magnetic recorder automatically records power line transients, permits engineer to view them on an oscilloscope at any convenient time. Unit will record effect of lightning, etc, or indicate line conditions just prior to failure. A unique system of pulse-time modulation is used to obtain a wide frequency response characteristic and to permit as many as 10 recording channels, manufacturer states.

Magne-Pulse Corp, 140 Nassau St. New York 38, N. Y.



Adjustable Protractor

720 • *Tractograf* permits drawing any number of angles, from zero to 180 deg without turning, sliding or moving protractor out of position. Simply swing upper

KEY-KAST

alloy steel welding fittings and flanges

APPROVED by leading
- refineries
- power plants
- chemical plants

2 REASONS *why Key-Kast fittings can be the strongest part of* YOUR *piping system—too!*

1. Engineered for longer life! Greater wall thickness throughout . . . for increased structural strength—plus greater allowance against corrosion and erosion.

2. Complete quality control. From the metallurgical laboratory through the latest testing facilities to the final inspection . . . Key-Kast products must pass the most rigid requirements—your assurance of maximum dependability.

Key-Kast Fittings and Flanges are available for prompt delivery in many shapes . . . sizes . . . and schedules . . . in low and intermediate alloys and various stainless steels . . . and at low unit costs.

Write for brochure and complete information . . . today!

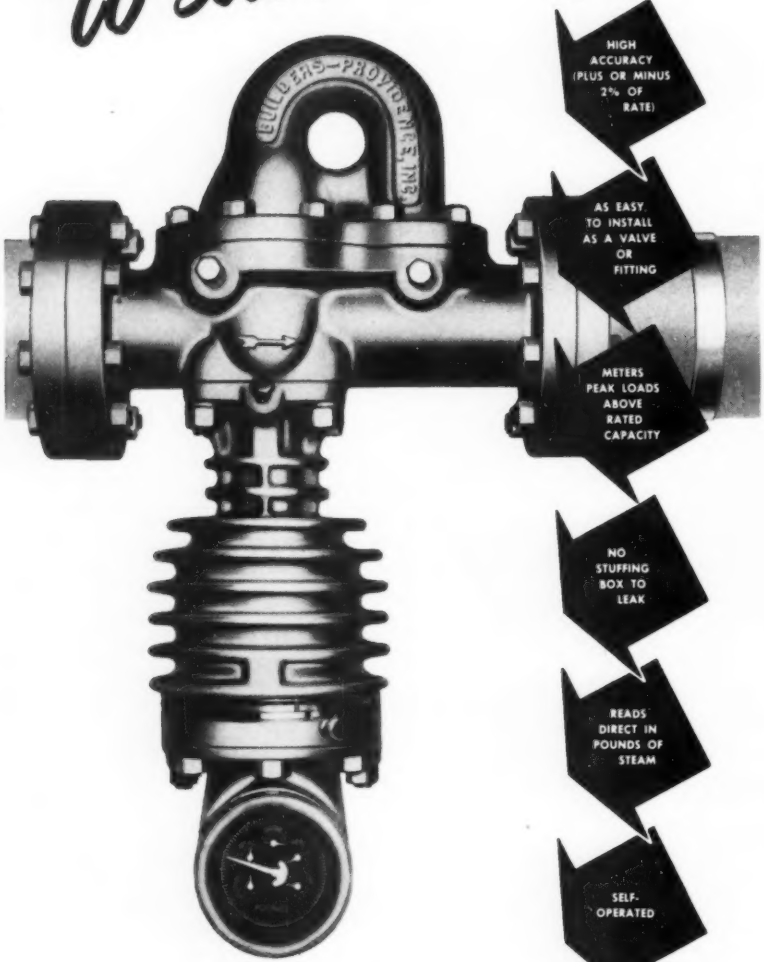
key company

Since 1916 . . . manufacturers and developers of products for high temperatures and pressures

P.O. Box 1910, Tulsa 1, Louisiana, Illinois

DISTRICT OFFICES: NEW YORK • CLEVELAND
CHICAGO • TULSA • HOUSTON • LOS ANGELES

Meter Steam to save money!


BUILDERS—PROVIDENCE, INC.
HIGH ACCURACY (PLUS OR MINUS 2% OF RATE)
AS EASY TO INSTALL AS A VALVE OR FITTING
METERS PEAK LOADS ABOVE RATED CAPACITY
NO STUFFING BOX TO LEAK
READS DIRECT IN POUNDS OF STEAM
SELF-OPERATED

Install BUILDERS SHUNTFLO STEAM METER right in the steam line like a valve or fitting. Get accurate steam consumption figures in pounds on the direct-reading meter dial. Shuntflo Steam Meters available in two styles: Model SMKS (shown) for 2" to 14" lines — Model SMDH for 1" and 1½" lines. Write for Bulletins. Builders-Providence, Inc. (Division of B-I-F Industries), 354 Harris Avenue, Providence 1, Rhode Island.

BUILDERS

BIF INDUSTRIES PIONEERS IN METERS AND CONTROLS BUILDERS

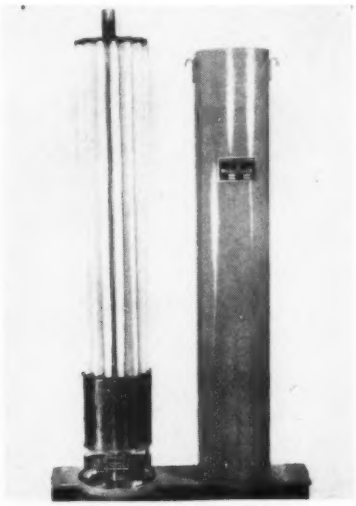
More EQUIPMENT NEWS

Begins on page 156

rule arm to desired angle and lock adjustment knob.

Protractor is made from clear plastic with smooth bevelled ruling edges.

Way-Mac Mfg Co, 8112 Melrose Ave, Los Angeles 46, Calif.



Compressed Air Filter

755 • New model A-100-D *Condensifilter* has disposable filter cartridge providing over 24 sq ft of filtering area. Cartridge is made of wire mesh and flannel cloth, can be replaced in a matter of minutes.

Condensing unit has area of more than 950 sq in. Dewpoint of air is lowered to within 2 or 3 deg of the cooling-water temperature, and entrained or vaporized water and oil are removed by condensation. Accumulated condensation is discharged through trap valve.

Hankison Corp, 270 Biltmore Bldg, 951 Banksville Rd, Pittsburgh, Pa.

For more data on these items, use post cards p. 165. Identify your request with item number.

Furnace Blowers

756 • Models DD9-6, DD9-9 and DD9-10 direct-driven furnace blowers for furnaces with 50,000 to 125,000 Btu input are available with 5-speed controls, optional, for heating system balance, and 4 angles of discharge. Units are claimed extremely quiet, economical and efficient.

The Lau Blower Co, Dayton 7, Ohio.

(*Continued on page* 196)

On again!

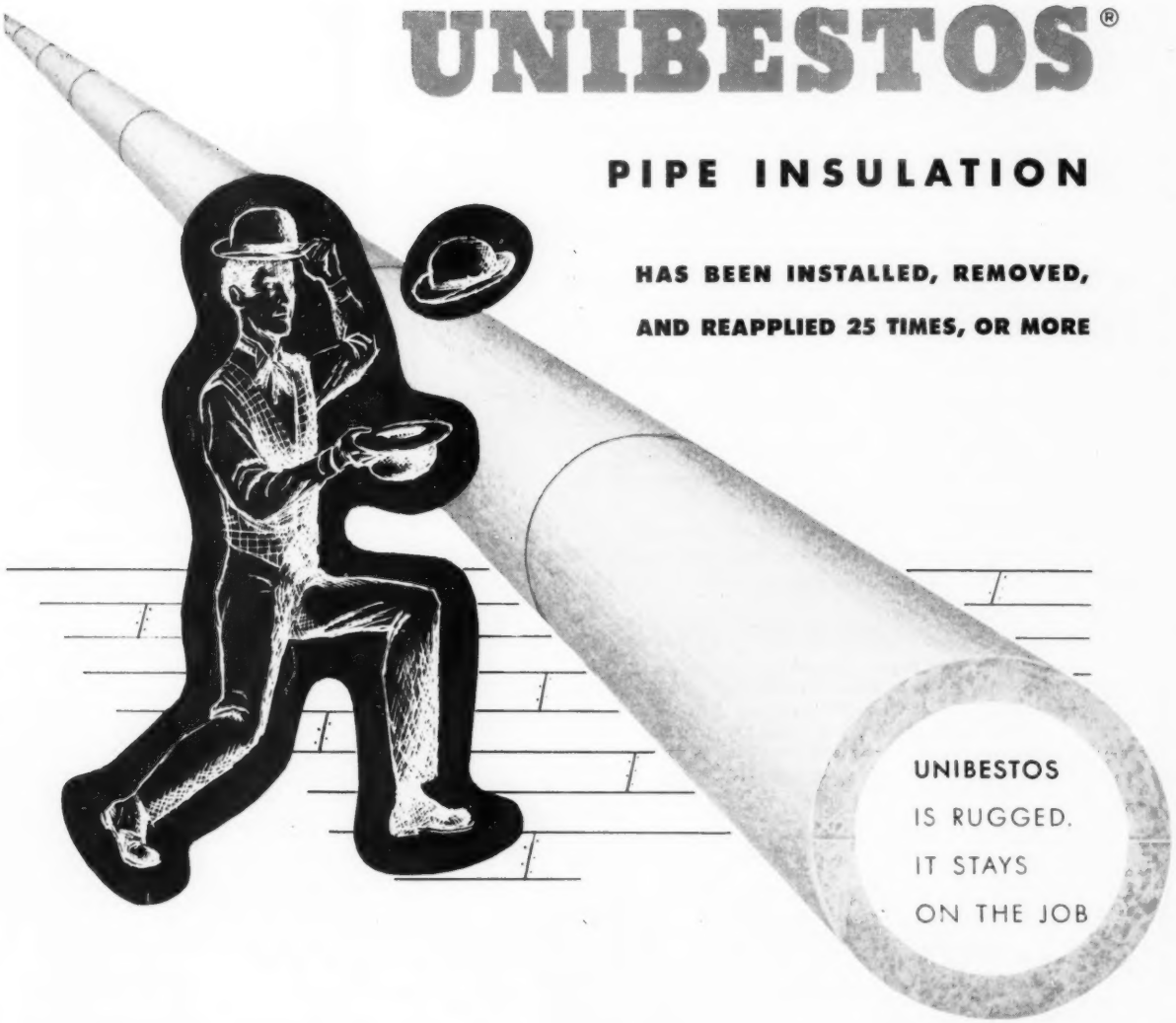
Off again!

UNIBESTOS®

PIPE INSULATION

HAS BEEN INSTALLED, REMOVED,

AND REAPPLIED 25 TIMES, OR MORE

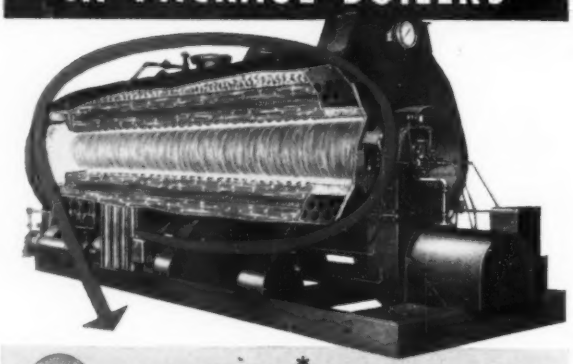


UNARCO

UNION ASBESTOS & RUBBER COMPANY

DEPT. C-7, 332 SOUTH MICHIGAN AVENUE, CHICAGO 4, ILLINOIS

THE BIG DIFFERENCE IN PACKAGE BOILERS



CYCLOTHERM* CYCLONIC COMBUSTION gives you 66% MORE POWER per sq. ft. of heating surface

The cyclonic action of the flame revolves evenly in a free spiraling vortex the full length of the furnace and provides an even rate of heat transfer throughout the entire length of the combustion chamber.

This controlled combustion reduces heating surface requirements from 5 to just 3 sq. ft. per B. H. P. giving 66% more power.

Plus These Important Features

- **Saves up to ⅓ the Space of Conventional Package Units**
- **Guaranteed 80% Minimum Efficiency**
- **No Hot Spots or Flame Impingements**
- **Burns Oil, Gas or Both**
- **Savings up to 50% on Maintenance**
- **No Expensive Stacks or Foundations to Build**
- **Greater Fuel Savings**

And That's Not All . . .

Cyclotherm Steam Generators with *patented* Cyclotherm Cyclonic Combustion gives you: Full power operation from a cold start in 15 to 20 minutes; Built in accordance with A.S.M.E. and Nat'l. Board Standards and bears the label of Underwriters Laboratories Inc.; Complete range of sizes from 18 to 500 h.p., 15 to 200 psi operation pressure.

WRITE TODAY for your copy of "All Your Questions Are Answered by Cyclotherm" and find out why Cyclotherm Steam Generators have been proven superior in thousands of installations. Just drop a post card to Cyclotherm, Dept. 24, Oswego, New York.

*Reg. trade name

CYCLOTHERM STEAM GENERATORS

More EQUIPMENT NEWS

Begins on page 156

Test for Boiler Water Solids

725 • Simple "dropper test" for boiler water solids can be made in two minutes, gives results reproducible to 200 ppm dissolved solids. A more precise "burette test" requires about three minutes and gives results reproducible to within 25 to 50 ppm.

Essentially the test involves mixing water sample with a strongly alkaline anion exchange resin, and titrating a portion of the resulting solution with acid to the proper endpoint. Volume of standard acid required for the titration, multiplied by a suitable factor, gives an accurate measure of dissolved solids in the sample.

Hagan Corp, P O Box 1346, Pittsburgh 30, Pa.

Spray-Type Foam Maker

702 • New foam maker is designed for overhead protection of medium-sized petroleum and chemical hazards. Cone-shaped spray head discharges an even pattern over a wide area. Device is designed for use in fixed systems, singly or in multiples, indoors or out. Coverage ranges from 10 to 20 ft in diameter, depending on operating pressure, which can vary from 30 to 100 psi.

Unit is about 15 in. long, 2½ in. diameter. Two capacities available: 22 and 33 gpm at 30 psi.

Pyrene Mfg Co, 560 Belmont Ave, Newark 8, N. J.

For more data on these items, use post cards p. 165. Identify your request with item number.

Portable Vacuum Tester

737 • New vacuum pump trucks can be used for vacuum processing or to test pipelines, vacuum and storage chambers, handling 2000 and 4000 cfm between 1 and 10 microns absolute pressure. The 2000 cfm model, 147-E-10, consists of *Microvac* pump, diffusion pump, high vacuum valve, ½-hp hermetically sealed refrigeration unit with baffled cold trap coil. All auxiliary piping,

This 7-Letter Word Tells the Story

• There are many descriptive words and phrases we might use to prove the effectiveness of Zallea Stainless Steel Expansion Joints as the ideal medium to absorb thermal expansion and contraction in pipelines. But no single word has more convincing meaning . . . more significance than the simple 7-letter word . . . "*reorder.*"

Over the past 23 years, thousands of industrial organizations have expressed their confidence in our products by reordering not once, *but time and time again!*

Here's a sample of the record:

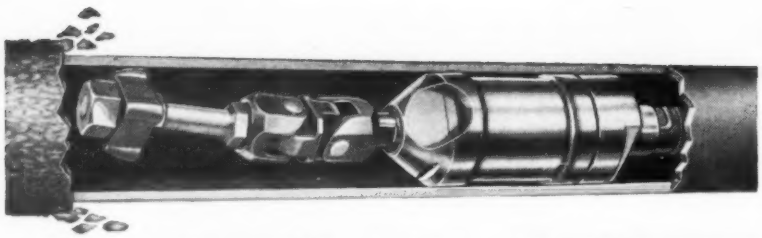
Company	Number of Orders Placed*	Since
American Viscose Corp.	79	1940
Bethlehem Steel Corp.	51	1935
Carbide & Carbon Chemical Co.	93	1936
Consolidated Edison Co.	115	1933
Dravo Corporation	53	1939
E. I. du Pont de Nemours & Co., (Inc.)	308	1934
Ebasco Services	46	1934
Hercules Powder Co.	133	1937
Koppers Co., Inc.	165	1942
Nordberg Mfg. Co.	174	1942
Sun Oil Co.	60	1935
Texas Co.	261	1938

**Including as many as 485 expansion joints in a single order!*

This acceptance is your assurance of the dependable, economical performance you'll receive when you, too, order and *reorder* Zallea Stainless Steel Expansion Joints. Why not write us *today?* Zallea Brothers, 814 Locust Street, Wilmington 99, Del.

Catalog 47 and Bulletin 351 describe the complete line of Zallea Expansion Joints and Flexible Connectors. Write for copies today.

Zallea
EXPANSION JOINTS



ROTOJET®

Cleans Fire Tubes ▸▸▸▸▸▸ FAST ▸▸▸▸▸▸

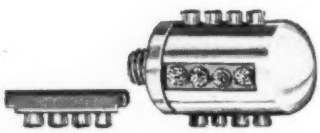
INSIDE *and* OUTSIDE

You can now clean fire tubes inside as well as outside faster with a new Rotojet. The new Rotojet is the most powerful tube cleaner we ever built. It won't stall at low speeds caused by heavy loads. Roto expanding heads and brushes thoroughly clean soot scale inside tubes. A Roto vibrating head (illustrated above) knocks off water scale adhering on the outside.

Try the new Rotojet, and no other tube cleaner will ever satisfy you.

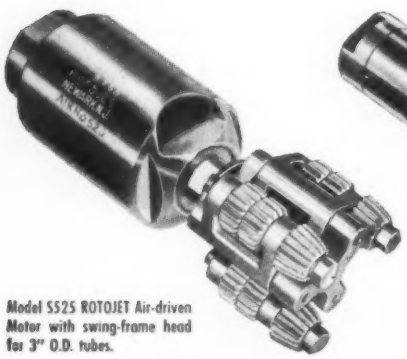
Economical Roto Brushes

Roto expanding brushes and heads have separately replaceable wearing elements. These inexpensive parts save time, money, and critical materials. Send for details.



Roto expanding brush, showing a replaceable brush element. Brings down tube cleaning cost. Maintains high cleaning efficiency.

Roto solid wire brush.



Model S525 ROTOJET Air-driven Motor with swing-frame head for 3" O.D. tubes.

Model S505 ROTOJET Air-driven Motor with 2-arm head for 2" O.D. tubes.

ELLIOTT COMPANY-ROTO DIVISION

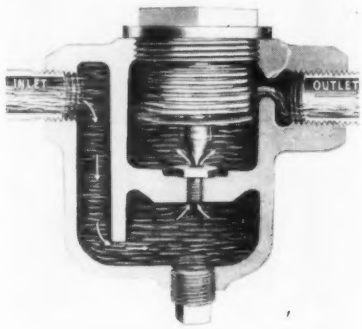
153 Sussex Avenue Newark 1, N. J.

More EQUIPMENT NEWS

Begins on page 156

valves, electrical controls are mounted on the common base. Connection for purchaser's manifold is standard 10 in. pipe flange having a center line 42 in. above the floor. Steel base has self-locking leveling jacks.

F J Stokes Machine Co, 5500 Tabor Rd, Philadelphia 20, Pa.



Steam Trap

758 • O.B.T. steam trap is designed for use on steam radiators and gravity air convectors with maximum pressure up to 100 psi. It is not usable on fan type unit heaters or process equipment.

Trap delivers condensate at temperatures between 190 and 205 F when return line pressure is zero.

Coe Manufacturing Co, Bank St, Painesville, Ohio.

For more data on these items, use post cards p. 165. Identify your request with item number.

Wheel Pipe Cutters

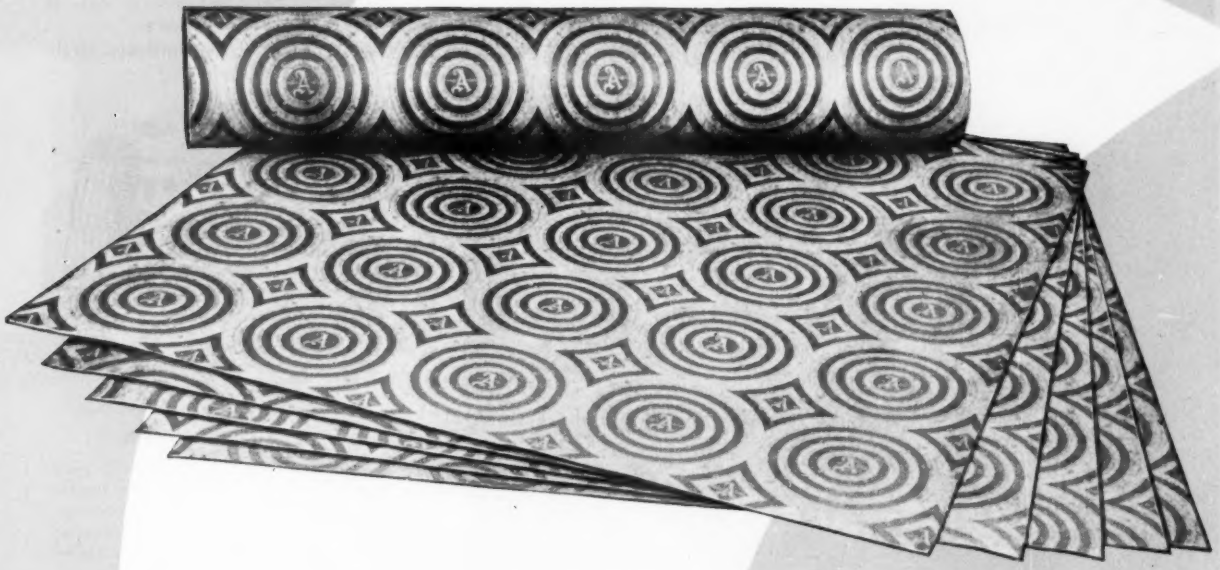
742 • New tool is available in two sizes —No. 2 for ⅛ to 2 in. pipe, and No. 4 for 2 to 4 in. pipe. Changes in cutting design permit power to be applied directly to the cutter wheel.

Beaver Pipe Tools, Inc, Warren, Ohio.

Dye Penetrant Test

759 • Dye penetrant test locates cracks in any solid material. For maintenance, tool inspection, weld, casting, or forging inspec-

ANCHOR TARGET GASKET SHEET



Withstands even the most severe conditions!

Because ANCHOR Target Gasket Sheet contains especially selected materials, expertly made, it is recommended for many chemical and acid services as well as where contact with oil or solvents might impair any gaskets containing a natural rubber compound.

ANCHOR Target sheet is a compressed asbestos, the fiber thoroughly impregnated with a heat-resisting synthetic immune to the action of oil and many petroleum solvents. Target sheet is branded with a circular brand making it especially easy to cut gaskets of many sizes.

You will find many uses for ANCHOR Target sheet, due to its superior construction.

For further information, write us today.

BRANCHES

BALTIMORE, MD.	MILWAUKEE, WIS.
BOSTON, MASS.	MONTREAL, CANADA
BUFFALO, N. Y.	NEW ORLEANS, LA.
CINCINNATI, OHIO	NEW YORK, N. Y.
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CLEVELAND, OHIO	PITTSBURGH, PA.
DAYTON, OHIO	SAN FRANCISCO, CAL.
DETROIT, MICH.	SEATTLE, WASH.
HOUSTON, TEX.	SPOKANE, WASH.
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WILMINGTON, CAL.	

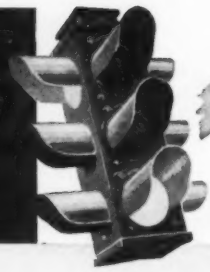
THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA. ELKHART, IND. MONTREAL, CAN.

FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

DRAFT FANS



GO on GREEN

- Two Induced Draft Fans, each 198,000 cfm; 300°F stack gas at 15" static pressure.
- And special features include: radial tip blades, erosion-resistant wheels, control type inlet dampers, air-cooled bearing for outdoor service.

This installation, located in the South, adds to the mounting evidence that Green Draft Fans are very much in the boiler plant picture, both utility and industrial... evidence that they are high on the specification lists of leading consulting engineering firms and on the owners' lists of acceptable equipment.

There are numerous things about Green Induced and Forced Draft Fans that make them desirable auxiliary equipment for any boiler. We suggest that you have the basic facts at hand when you start planning for your fans. Send for our Bulletin 168 and in writing, tell us about your requirements.

THE GREEN Fuel Economizer COMPANY INC.

- Economizers
- Fans
- Air Heaters
- Cinder traps
- Aerodyne Dust Collectors

BEACON 3, NEW YORK

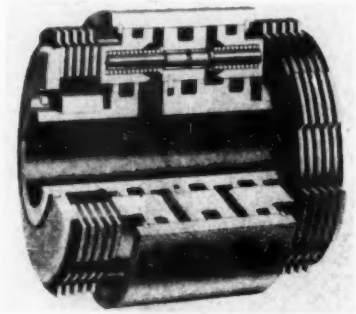
Photo above shows the Green ID Fans being installed in the Chesterfield Power Station Extension of the Virginia Electric and Power Co., at Drewrys Bluff, Virginia.

More EQUIPMENT NEWS

Begins on page 156

tion, etc, *Spotcheck* kit makes tests for cracks in a few minutes. No power or special lights are required. Dye penetrant is sprayed on surface to be tested, followed by cleaner and developer. Cracks show up as bright red lines, and pores or leaks in tanks show as bright red spots.

Magnaflux Corp, 5900 Northwest Highway, Chicago 31, Ill.



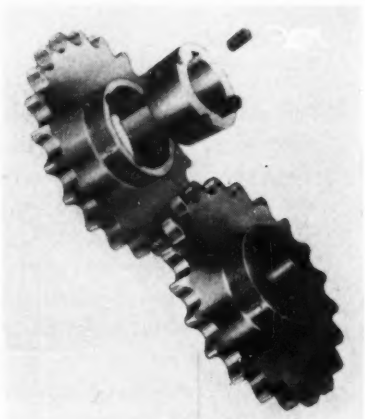
Oil-Actuated Clutch

760 • New oil-actuated multiple-plate clutch is available in single and duplex models. Manufacturer claims that unit requires no adjustment, features constant torque capacity, compactness, adaptability to remote control, long wear life.

Design incorporates an integral oil cylinder to clamp the plate stack, snap rings to provide easy disassembly. As plate stack wears, ram travel increases automatically, maintaining constant torque capacity.

Twin Disc Clutch Co, Racine, Wis.

For more data on these items, use post cards p. 165. Identify your request with item number.



Roller Chain Sprockets

728 • *Jiffy* sprockets and bushings employ taper-lock principle to assure good fit on the shaft. There are no flanges or protruding parts. They will be available in a range of sizes for the majority of industrial applications. Reboring sprockets to fit shafts is eliminated. Folder J-1.

Union Chain and Mfg Co, Sandusky, Ohio.

(*Continued on page* 202)

LOOKING DOWN YOUR PIPELINE . . .

. . . what do you see? Dependability . . . or frequent failure; long, economical life . . . or costly maintenance; W-S FORGED STEEL FITTINGS . . . or the ordinary kind that are a source of constant trouble and expense?

W-S Screw-end and socket-weld fittings are the *only* type that become integral parts of your steel pipe-lines . . . their forged steel construction matches that of the pipe or tubing in chemical and physical properties, in strength, weight and resistance to pressure . . . heat . . . corrosion.

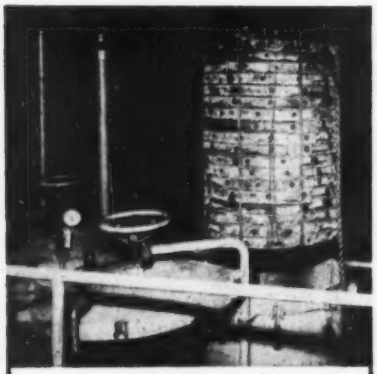
Whatever your pipe or tubing application, you can profit from the permanence of W-S Fittings. Initial cost is often *less;* final cost is always *least.* Literature is available . . . write for it.

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

133 ALDENE RD., ROSELLE, NEW JERSEY

9-0-1



Leaf assembly being removed from one of three vertical filters at B. F. Nelson.

How B. F. Nelson Mfg. Co.

increased condensate in boiler feed 70%

with SORBO-CEL®

When B. F. Nelson Mfg. Co. added new 425-psi boilers, oil in condensate was an expensive problem . . . until they switched to Sorbo-Cel filtration.

Average oil concentration in old boilers was 65 ppm. Concentration in condensate receivers ran 33.4 ppm, mostly emulsified. About 50% of boiler feed was condensate. Problem: to keep oil out of new boilers. *By comparing methods, they found that filtration with Sorbo-Cel . . . a specially processed diatomite filter aid . . . did the best job.*

Sorbo-Cel slurry is fed into condensate to attract oil and hold it until it reaches filters. Sorbo-Cel collects on plates and builds up a highly porous cake. Operation is continuous until there is no more room for cake between plates—usually 70 hours.

Today, 85% of boiler feed is condensate. Labor-and-material costs are only 1.7 cents every 1000 lbs. Since B. F. Nelson produces two million pounds of steam a day, savings from reclaiming such a high percentage of condensate can readily be imagined.

For further information about Sorbo-Cel filtration mail the coupon below.

Johns-Manville

SORBO-CEL

Johns-Manville
Box 60, New York 16, N. Y. POW-7

Please send me free bulletin giving advantages of Sorbo-Cel filtration.

Name_____

Company_____

Address_____

City_____ State_____

More EQUIPMENT NEWS

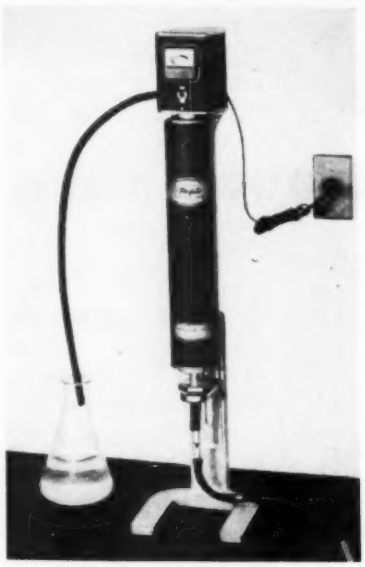
Begins on page 156

Bolt-End Insulator

735 • New porcelain insulator is designed to shield the projecting ends of transformer support bolts to protect personnel working on live lines. (Support bolts are at ground potential when the transformers are grounded, thus ordinarily creating a hazard.)

Lapp Insulator Co, Inc, Le Roy, N. Y.

For more data on these items, use post cards p. 165. Identify your request with item number.



Cartridge Demineralizer

714 • New demineralizer features a permanent cartridge, an electric purity indicator, and a sight indicator for adjusting intake flow to the optimum rate for efficient ion exchange action. Unit can supply up to 10 gph of high purity water, is useful for laboratories, storage batteries, etc. To operate, connect intake hose to the tap, insert outlet hose in a receptacle, and turn on the faucet. Purity meter warns when resin charge in the cartridge requires replacement.

Penfield Mfg Co, Inc, Attention E H Clohessy, 19 High School Ave, Meriden, Conn.

Dependable POWER—HEAT

for a 37-building Veterans' Hospital

TITUSVILLE IRON WORKS CO TITUSVILLE PA

TICOTHERM STEAM GENERATORS

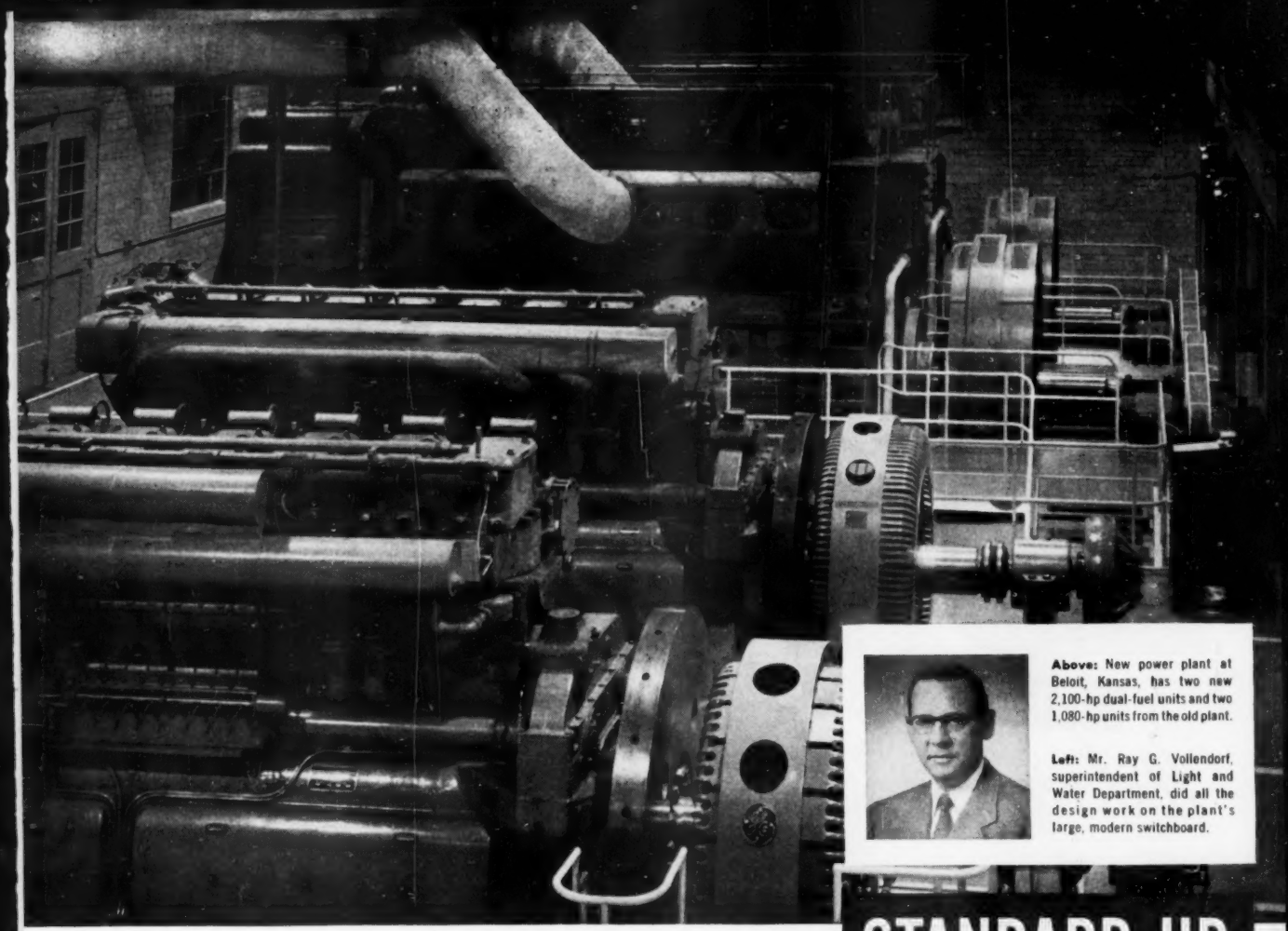
This battery of four Ticotherm Steam Generators dependably and economically serves the power and heat requirements of the 2000-patient Franklin Delano Roosevelt Veterans' Administration Hospital at Peekskill, New York. Ticotherm Steam Generators are always your sound choice for maximum steam output at lowest operating cost. *Write for details!*

THE TITUSVILLE IRON WORKS COMPANY

A division of Struthers Wells *Representatives in Principal Cities*

TITUSVILLE, PENNSYLVANIA

Manufacturers of **A COMPLETE LINE OF BOILERS FOR EVERY HEATING AND POWER REQUIREMENT**



Above: New power plant at Beloit, Kansas, has two new 2,100-hp dual-fuel units and two 1,080-hp units from the old plant.

Left: Mr. Ray G. Vollendorf, superintendent of Light and Water Department, did all the design work on the plant's large, modern switchboard.

STANDARD HD
TRADE MARK
OIL

New Beloit, Kansas, plant gets record low maintenance with...

● Acclaimed as one of the municipal showplaces of the Midwest, the new power plant at Beloit, Kansas, is going itself one better in actual performance.

The decision of Mr. Ray Vollendorf, plant superintendent, and city officials to switch to dual-fuel operation has paid dividends. Dual-fuel operation of the two new 2,100-hp units and a 1,080-hp converted unit has reduced fuel cost per kilowatt hour by more than 50%.

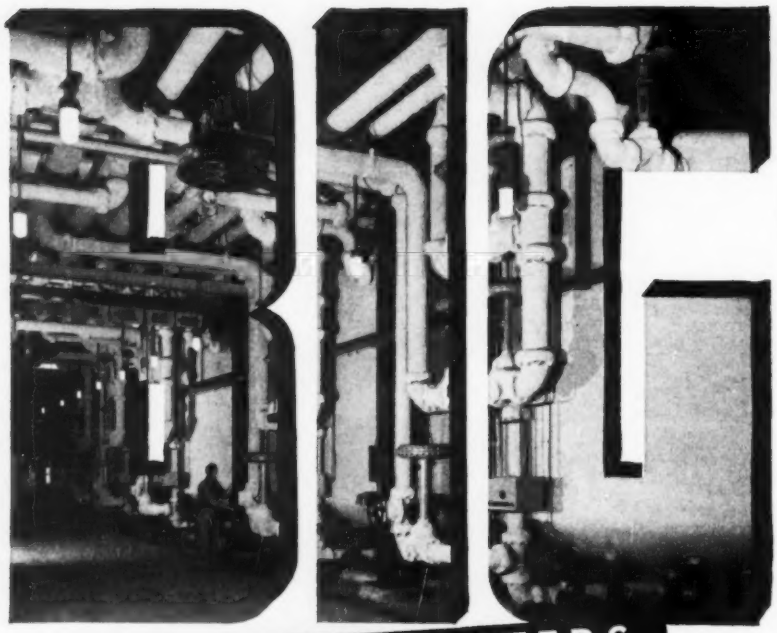
Another decision has brought its reward. To STANDARD HD Oil went the job of lubricating the plant's four diesels. Now, after nearly two years' operation, Mr. Vollendorf reports that crankcases are as clean as the day the diesels were placed in service. No rings or bearings have needed to be replaced. Visibility of tool marks on the rings and the over-all excellent condition of the engines indicate that many more hours of service are possible before any overhaul or replacement of parts will be required.

Including the two years' operation of the new plant, the experience of Beloit, Kansas, municipal officials with Standard Oil products covers 20 years. That experience testifies to the satisfaction and benefits you'll realize through Standard Oil's high quality products and outstanding service. You can reach the Standard lubrication specialist in your area of the Midwest by phoning your local Standard Oil office. Or, write: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois.

STANDARD OIL COMPANY

STANDARD

(Indiana)



DEMINERALIZERS

USE

Nalcite® ION EXCHANGE RESINS

(DOWEX*)

THIS demineralizer, one of the world's largest, provides 100% makeup for 1250 psi boilers generating 1,200,000 pounds of steam per hour. Using Nalco ion exchange resins, Nalcite HCR® and Nalcite SAR, silica is successfully removed from the feedwater — as illustrated by the fact that after 75 to 100 concentrations, silica content of the boiler water is still *less than 5 ppm!*

In demineralizers large or small, Nalcite ion exchange resins give top performance. They are chemically and physically stable for long life at top efficiency. *Two* Nalcite anion exchangers . . . your choice of SAR or SBR . . . are available to meet the conditions of your water supply. Either, used with Nalcite HCR, offers top quality demineralized makeup for high pressure steam generators.

*Reg. Trademark of The Dow Chemical Company.

DATA ON SILICA REMOVAL

A new edition of Nalco Bulletin 57 gives technical data on Nalcite SAR and Nalcite SBR anion exchangers . . . includes complete up-to-the-minute information on silica removal. Write for your copy today.

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago 38, Illinois

In Canada: Alchem Limited, Burlington, Ontario

Nalco®

PRODUCTS • *When you use Nalcite resins, you take advantage of Nalco's long and broad experience in water and process technology.*

More TECHNICAL BRIEFS

Begins on page 152

wire the unit to the ac supply and make the connections to the dc motor and control station.

Simplicity of installation of the package unit makes it well suited for spot conversion. When laying out a new plant the ac wiring need be the only electrical consideration. If a machine is installed requiring a dc supply, a packaged adjustable-voltage drive may be specified and the dc supply along with the required control is obtained in a single unit. A packaged adjustable-voltage motor-generator set can also be used for constant-voltage supply to provide additional capacity for an existing dc system or to provide the only dc source in a small plant.

A packaged adjustable-voltage drive is well suited for applications requiring a wide range of operating-speeds controlled by the operator. It can provide close speed control, smooth acceleration and deceleration and rapid stops by dynamic or regenerative braking.

Package drives are not limited to obtaining adjustable speed. Many control functions may be built into them while proving all their other advantages. If auxiliary control is required it can be supplied on the panel with the rest of the control. This makes it possible to complete the connection for the entire unit and eliminates the need for extra control panels and enclosures. *AIEE conference paper. Can be obtained from the author.*

Packaged-Drive Design Problems. *By E H Vedder, Westinghouse Electric Corp, Buffalo, N. Y.*

The trend toward packaged adjustable-speed drives is increasing because of the many advantages they offer to machine builders and users. A packaged drive is easier to install because the many parts previously shipped separately are now factory assembled in a metal cabinet and tested. Drives that use motor-generator sets for power conversion in ratings up to 300 hp are considered in this paper. Ratings of these drives follow the same steps as dc motors. Only seven sizes of cabinets are required to package drives of 1 to 200 hp. However, the control functions which must be provided for are staggering. For example, about 1000 drive designs are needed to cover ratings from 1 to 30 hp, 230, 460 and 575 v, 60 cycles.

A few simple principles should be followed in applying and designing packaged drives. These are:

1. Packaging is not a necessity. Un-

Directions for ordering papers on p 154

How much STRENGTH should a bus conductor have?

Indoors or outdoors you want bus conductors that have maximum structural strength. Chase square copper tube bus conductors have relatively large cross-sectional areas, permitting longer spans between supports.

The high mechanical strength of Chase buses is also important in withstanding the powerful forces caused by heavy short circuit currents.

For ventilated square copper tube bus conductor as well as round tube and flat rectangular bus, insist on Chase.

• Write us for free Chase Bus Conductor Brochure.

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Baltimore	Denver †	Milwaukee	Pittsburgh	Waterbury
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Steam + CORAVOL = Protection (FROM CORROSION)

(The Original* AMINE PROCESS) ®

Because CORAVOL Circulates to Control Corrosion

CORAVOL circulating throughout your steam system protects it from corrosive attack. **CORAVOL** saves costly pipe repairs and replacements—maintenance labor—hours and days of shutdown loss. **CORAVOL** cleans out clogging rust deposits, improving heat transfer, restoring original capacity of lines and efficiency of valves and traps.

CORAVOL, the original* amine process, has the flexibility that lets it conform to each individual need. The **CORAVOL** *you* will use is formulated to do the best protective job under your own plant conditions.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special chemical formulas for: boiler feed water . . . foam prevention . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

*The use of **CORAVOL** in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

Chemical Water Treatment

WESTERN CHEMICAL COMPANY

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Kansas City 6, Missouri

MAIL COUPON TODAY for
Complete Data about the CORAVOL Process

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Send me full information about CORAVOL.

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STATE _____

More TECHNICAL BRIEFS

Begins on page 152

less there is an overall advantage to the purchaser the drive should not be packaged.

2. Engineering design costs tend to be higher on complex packaged drives than on non-packaged equipment.

3. Drive designers must not be handicapped by the purchaser insisting on a specific solution to a problem merely to follow tradition or a personal preference. *AIEE conference paper. Can be obtained from the author.*

Directions for ordering papers on p 154

Packaged Adjustable Voltage Drives. *By S P Finnegan, W H Turner, Jr, General Electric Co, Schenectady, N. Y., and L Wolfson, General Electric Co, Lynn, Mass.*

Adjustable-voltage drives in which the adjustable-voltage source is a dc generator, the shunt field strength of which is varied, are covered. The principal advantage of these drives are:

1. Wide speed range below base by armature control at constant torque. This range can be extended above base speed by shunt-field control at constant horsepower.

2. Low, threading or jogging speeds can be obtained easily.

3. Torque at starting, during acceleration, retardation and dynamic braking can be easily and accurately controlled.

4. Direction of machine-drive motor can be reversed by reversing generator-armature or shunt-field connections.

5. Since speed is controlled by adjusting generator field current, accurate speed, current and current-limit regulators can be included in the control circuit.

6. Several motors operating in tandem may be connected to one generator. Adjusting the generator voltage adjusts the speed of all motors simultaneously. Speed of each motor may also be adjusted by motor-field rheostat.

Preference for packaged equipment has increased because:

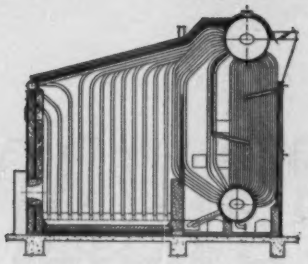
1. It is easy for the customer to order the equipment. He can think in terms of what he wishes to accomplish, and then gets a packaged unit to do this job.

2. Factory assembled equipment greatly reduces installation costs.

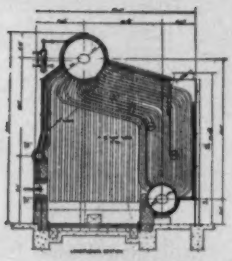
3. Packaged units are more compact and require less space than non-packaged equipment to do the same job.

4. The package manufacturer takes complete responsibility for the equipment's operation. *AIEE conference paper. Can be obtained from the authors.*

(*Continued on page* 208)



2 Drum Water Tube Boiler



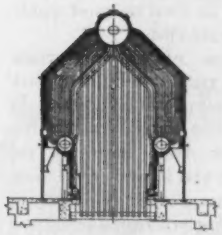
Type-S 2 Drum Boiler Series 31

FOR ALL INDUSTRY...

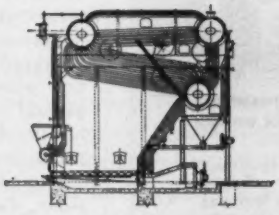
WICKES

STEAM GENERATORS

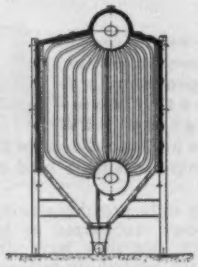
• In the oil, paper and chemical industries and in manufacturing plants, institutions and public buildings throughout the world Wickes Steam Generators are in constant daily service. All types, such as those illustrated on this page, with capacities up to 250,000 lbs. steam per hour and 1000 psi. Write for descriptive literature.



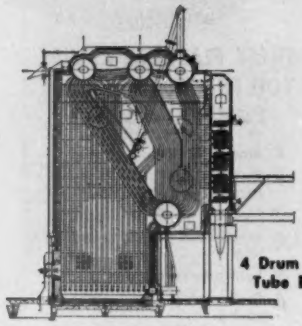
"A" Type Water Tube Boiler



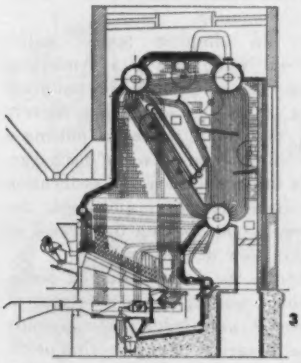
3 Drum Low Head Water Tube Boiler



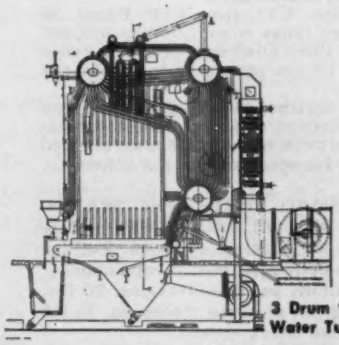
Wickes 2 Drum Waste Heat Installation



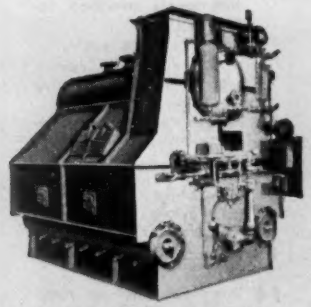
4 Drum Water Tube Boiler



3 Drum Water Tube Boiler



3 Drum "B" Type Water Tube Boiler



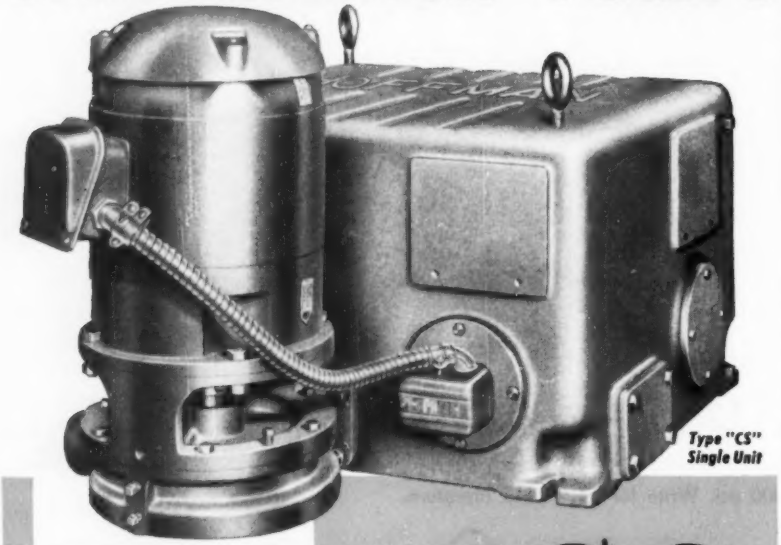
Type "A" "Packaged" Steam Generator

THE WICKES BOILER COMPANY • DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

RECOGNIZED QUALITY SINCE 1854 • SALES OFFICES: Atlanta • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Greensboro, N.C. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Pittsburgh • Portland, Ore. • Saginaw • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D.C.

HOFFMAN

NEW IMPROVED CLOSE-COUPLED CONDENSATION PUMPS

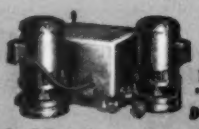


Type "CS" Single Unit

THESE FEATURES ASSURE YOU THE MOST MODERN PUMP AVAILABLE

1. Bronze fitted throughout.
2. Enclosed, precision balanced bronze impeller.
3. Stainless steel impeller hub.
4. Renewable bronze wearing ring.
5. Split bronze packing gland.
6. Drain plug for impeller casing.
7. Standard ball bearing motor, 40°C continuous duty, with ample overload capacity.
8. Heavy cast iron receiver.
9. Heavy duty float control, seamless copper float and brass rod.
10. Impeller has top suction inlet—eliminates air or vapor binding.
11. No piping between pump and receiver.
12. Float switch adjustable to various water levels.
13. Rigid motor support, very quiet.
14. Threaded outlet on pump cover to provide drainage and eliminate base with drip lip.

Hoffman, an old name on pumps, is proud to present a completely NEW line of Close-Coupled Condensation Pumps in single and duplex units!



Type "CD" Duplex Unit

Not only are these compact Hoffman Pumps recognized as highly efficient units, but they have design features which amazingly prolong service life, at low upkeep cost. They are so constructed that all parts subject to wear can be easily renewed. All cast iron and bronze construction.

Series "CS" and "CD" Pump capacities range from 1,000 to 150,000 sq. ft. EDR. Discharge pressures range from 10 lbs. per sq. in. to 60 lbs. per sq. in.

All together, these pumps are a rare combination of sound design and excellent workmanship. Units are shipped ready for connecting to the system.

FOR SMALL SYSTEMS THE "WATCHMAN NO. WC 8-20" PUMP for low pressure heating systems. Rating: 500 to 8000 sq. ft. EDR. Pump Capacity: 12 gallons per min. Pressure: 20 lbs. per sq. in. at pump discharge. ⅓ HP Standard Nema motors.

HOFFMAN SPECIALTY MFG. CORP., Dept. P-7, 1001 York St., Indianapolis, Ind.

Makers of Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems. Sold by leading wholesalers of Heating and Plumbing Equipment.

More TECHNICAL BRIEFS

Begins on page 152

The Electronic Packaged Drive. *By E F Kubler, General Electric Co, Schenectady, N. Y.*

Electric adjustable-speed motor controls have proven themselves in hundreds of industrial applications. Because of the ever widening demand for precise control of reasonable cost, standard electronic package drives are available in a range from fractional to over 30 hp. These small compact drives are used on office machinery, machine tools, automatic display stands and a multitude of other applications. It is generally accepted that electronic drives have the following advantages.

1. Compactness and light weight make them suitable for most applications.
2. They are so flexible that there are few applications that cannot be handled by them.
3. Their high performance accuracy makes them an ideal drive for continuous industrial processes.
4. Their high speed of response makes them suitable for high-speed manufacturing methods.
5. Their wide range of speed and horsepower covers most industrial needs.
6. Their overall efficiency is as good or better than other drives.
7. Because of the absence of rotating machinery they require little maintenance.
8. Due to their flexibility and adaptability they can be used on most applications at moderate cost.

These features of the electronic packaged drives put them in good position when compared with others. In general it has been found that the use of an electronic drive increases the processing speed and improves the manufactured product. *AIEE Conference paper. Can be obtained from the author.*

Stream Pollution Control. *By Edward J Cleary, Ohio River Valley Water Sanitation Commission.*

Stated in simplest terms, pollution of our waterways is a symbol of progress. The solution to the pollution problem is not, as some have naively insisted, the simple matter of putting a legal prohibition on all waste discharge. Such an attempt deserves classification in the same category—and with the same results—as seeking the repeal of the natural law of gravity.

Neither is the solution to the pollution problem waiting on the development of technical knowledge. We already have a wide variety of engineering methods to modify, treat or otherwise reduce nearly all types of pollution. If there

Directions for ordering papers on p 154

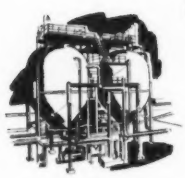
Part of Shell Oil Company's modern Houston, Texas refinery which processes 125,000 barrels of crude oil daily.

PERMUTIT
ION EXCHANGERS

deliver highest purity makeup for

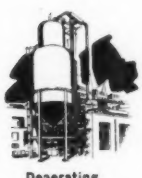
SHELL

BOILERS in this enormous Shell refinery operate at 650 psi. Steam output is received by turbo-generators . . . exhausted to process. ¶To insure continuous steam turbine operation—for greater efficiency and more economical production—Permutit Demineralizing Equipment treats makeup water. The ion exchange units at right have a continuous capacity of 96,000 gph. ¶The raw well water supply contains high total dissolved mineral solids—324 ppm, a harmful amount of silica—13 ppm. Its total hardness is 70 ppm, methyl orange alkalinity 230 ppm. ¶This installation—a Permutit Two-Step Demineralizer with Degasifier—removes virtually all dissolved mineral solids. Silica is reduced to under 0.2 ppm. The effluent is purer than most distilled waters, costs much less to produce. Most important, costly shut-downs from heavy scale on turbine blades are prevented. ¶Permutit makes all types of ion exchangers and water conditioning equipment . . . can save you time and money in the specification of the one combination that best suits your needs. ¶For aid in solving your own water problems, write to The Permutit Company, Dept. P-7, 330 West 42nd St., New York 36, N. Y. or Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

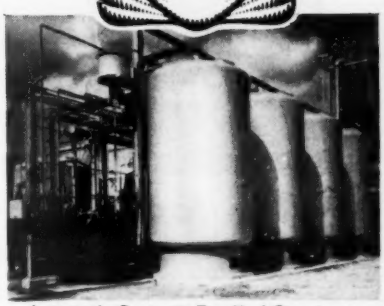


Sludge Blanket Hot Lime Soda

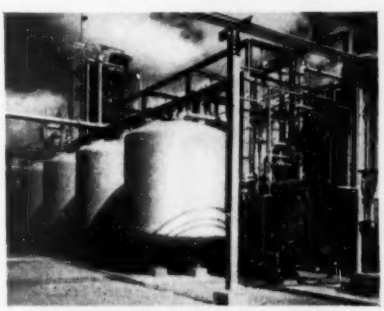
Hot Zeolite-Permutit Q



Deaerating Heater



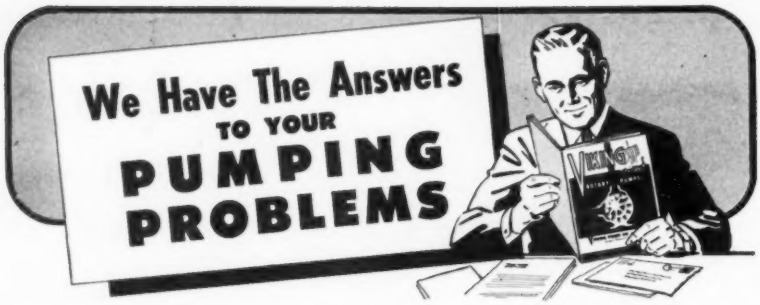
Automatic Permutit Zeo-Karb® units remove metallic cations from Shell's well water supply. Effluent passes to Degasifier at right for low cost CO_2 reduction.



Automatic Permutit S units remove remaining troublesome mineral impurities by anion exchange.

PERMUTIT®

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS



Every day the Viking sales and engineering staffs answer questions on pumping for a long list of satisfied customers.

Many are companies with problems very similar to yours.

These questions can be answered correctly because Viking people draw from over 40 years' successful pumping experience and recommend from the fastest-growing, most complete line of rotary pumps on the market. Over 600 standard models plus endless special designs. There's no compromise with Viking Pumps. We invite your questions on pumping problems.

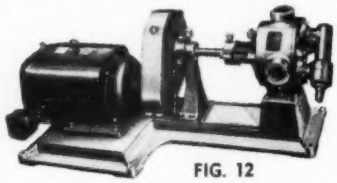


FIG. 12

VIKING
AN HONORED NAME IN PUMPING

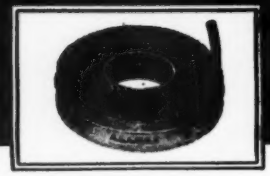
Learn about the complete line of Viking lube and diesel oil pumps for either integral mounting on engines or as separately powered units. Send for folder 53SW today.

See Our Catalog in SWEETS

VIKING PUMP COMPANY
CEDAR FALLS, IOWA

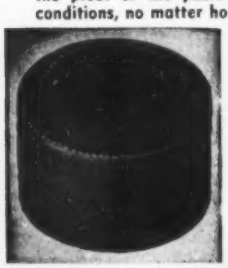
ALLPAX

...the Packing that PACKS ALL



The tougher the job, the more convincing the proof . . . .

The fact that ALLPAX develops packings for all services using only materials of highest quality, means that ALLPAX gives you the packing best adapted to your specific conditions. Obviously, ALLPAX *must be superior.* A trial will convince you that the proof of the packing is in its better, more economical performance under any conditions, no matter how tough.



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More TECHNICAL BRIEFS

Begins on page 152

were sufficient incentive and cash to apply the know-how already available, there would be no pollution problem.

The record of past action in our municipalities is not characterized by alacrity in meeting responsibilities for sewage disposal installations. In large measure it reflects an attitude that, with only so much money in the city treasury, the citizens have been quite willing to defer sewage-treatment necessities in favor of other public-works improvements.

Perhaps the greatest retarding influence to the vigorous enforcement of pollution abatement measures has been the erroneous impression in many places that industries would bypass, or depart, from those areas where a proper effort was being made to conserve water resources. The reasoning goes like this: If you want industrial expansion in your state, you must avoid rules or regulations about pollution control. Industry is opposed to such measures. Such a viewpoint is fallacious. *APC Paper, no number.*

Directions for ordering papers on p 154

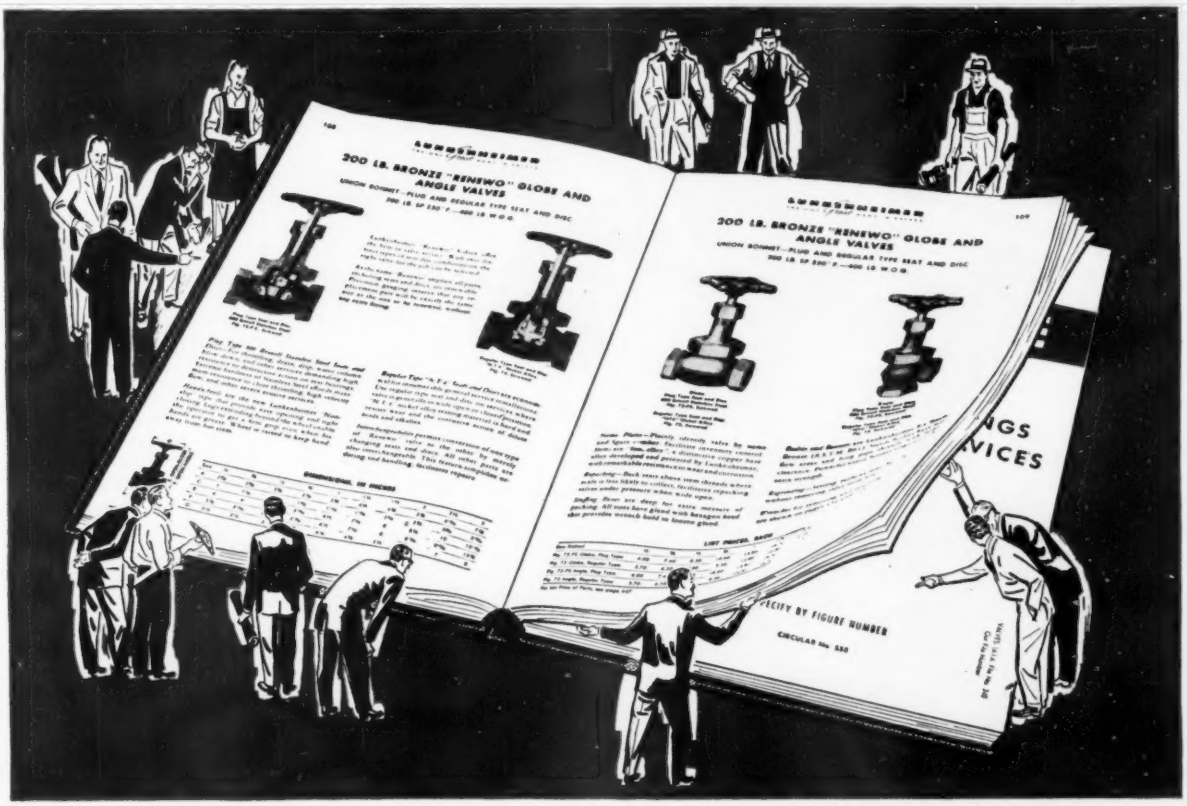
Current Developments in Louisville, Ky. Air Pollution Problems. *By E N Helmers, E I duPont de Nemours & Co, Inc.*

Air pollution problems in the West End of Louisville have caused considerable public agitation and strenuous efforts of industries in the area, known as Rubbertown, to reduce pollution to unobjectionable levels. The industrial concentration erected during World War II in this area to produce synthetic rubber for the government has its prevailing winds come from south and west.

In 1943 dust arising from a calcium carbide plant caused a shut-down followed by the installation of dust control equipment and a high stack at a cost of more than a million dollars. Little improvement resulted even during the period when the plant was closed, and public agitation continued. In 1949-1950 the University of Louisville studied the dust problem in the West End and concluded that concentration was less there than in central Louisville and that no single industry was a major contributor to the dust found in the western part of the city. It appeared that 55 industries, mostly outside the Rubbertown area, were involved.

Continuing complaints to the Louisville Air Pollution Control Commission resulted in new legislation in March 1952. Nine out of 11 industries in Rubbertown have contributed $50,000 for a detailed survey being carried out by

New 500-Page LUNKENHEIMER Catalog



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More TECHNICAL BRIEFS

Begins on page 152

Battelle Memorial Institute in close cooperation with the Jefferson County Air Pollution Control officials. Muca work has been done, and while the survey cannot be expected to solve the entire problem it will provide better understanding and point to corrective action that can be taken by industry and the community. Concurrently, industry is installing many types of control devices. Three industries have appropriated $450,000 for control equipment and others are in the design stages. This willingness of industry to do everything scientifically possible to abate pollution has not calmed public hysteria for drastic action. The problem is complex and will require time to solve. Shutdown of the new industry would give only partial relief. With patience and understanding that industry is a good neighbor cooperating in a community-wide problem, progress will be made. *MCA Paper, no number.*

Air Pollution Problems in the Houston Area. *By Don Wynn, Houston Chamber of Commerce.*

The concentration of industrial plants, oil refineries, ship wharves, steel, cement, chemical and fertilizer factories erected along the Houston ship channel in recent years have created an air pollution problem.

A $2.2 billion dollar investment in 100 plants with 66,000 workers and a payroll of $278,000,000 within little more than a decade has made Houston the South's largest city and second busiest port area in the country. Basic industries locating here have spawned hundreds of diversified businesses. The desire of workers to live close to their jobs in the ship channel plants has seen new communities arise close to the industrial zones.

Public protests since 1951 about atmospheric pollution have intensified the work of industry in this area under the Chamber leadership. Since 1947 a recent survey showed more than $8 million has gone into devices to reduce air pollution in Harris County. Another $4 million of equipment has been authorized. Although less than 26,000 of the 900,000 people in Harris County are affected by air pollution, such an outcry has been generated that it has only been with difficulty that law-suits and injunctions involving serious dislocations have been staved off.

Our first aim is to inform the public about remedial measures under way. We must also determine the level of contamination permissible and see that in-

Directions for ordering papers on p 154

Check List

for selecting a Piping Contractor

Listed below are a number of important factors that should be taken into account whenever you select a piping contractor. If any of these are overlooked, you are not buying your piping construction to best advantage.

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☐ **PROGRESSIVE ORGANIZATION** • You want a contractor who keeps abreast of new piping developments. Piping research on a continuous basis should be his policy.

☐ **CONVENIENT LOCATION** • A fabricating plant near enough to give you quick service is of prime importance. Convenient location also improves overall supervision of the job

☐ **SUPERIOR FIELD FACILITIES** • A job of any size needs a resident superintendent with a permanent staff of supervising erectors. Welders should be qualified on your materials.

☐ **PLUS SERVICES** • The experienced contractor often can make suggestions that result in improved piping design and savings in time and money.

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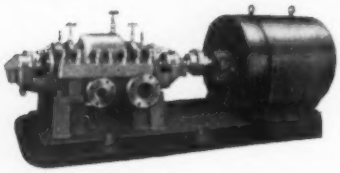

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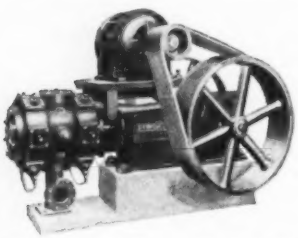

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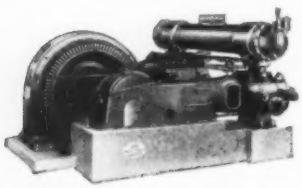

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More TECHNICAL BRIEFS

Begins on page 152

dustry, which is the lifeblood of the county, is not badgered or hampered in its progress as long as it adheres to these levels. Industry is not apathetic, but its concern and the steps it is taking to cope with the problem must be told to the public. *MCA Paper, no number.*

Stack Sampling Procedures Used to Evaluate Emission. *By J Brennan Giscard, American Cyanamid Co.*

With certain exceptions there are no standard procedures for stack sampling to use. Most of the time industrial hygienists must rely upon their own ingenuity in carrying out this work. Yet sampling procedures should make it possible to take numerous samples during a stack emission if peak concentrations are to be noted.

Complicated and heavy sampling equipment discourages stack sampling so that recourse must be made to simple, portable apparatus. The use of glass syringes and small electrically driven apparatus is described which have facilitated the taking of as many as fifty samples during one period of stack emission.

The application of sensitive color reactions and simple titrations which can be done on the spot are further aids to stack sampling and analysis.

Complaints of air pollution are frequently the result of momentary heavy emissions. Charts are presented showing the type of information obtainable by "spot sampling" techniques. The sampling data includes the peak and average concentrations so that engineering design can satisfactorily size the control equipment to be provided.

Additional benefits can also be derived from stack sampling. Information on reactions and reaction products which might have never been known is frequently revealed by stack sampling data. For example, it helps plant management to decide on the feasibility of salvaging valuable gaseous byproducts or changing operating procedures to insure greater yields of final product. *MCA Paper, no number.*

Directions for ordering papers on p 154

Air Pollution and Human Tolerance. *By John H Phair, MD, University of Cincinnati.*

Man must continuously contend with various forces in his environment which menace his health and well being. One of these is the pollution of the atmosphere by various irritant or toxic materials derived from the combustion of fuels or certain industrial processes.

(*Continued on page 216*)

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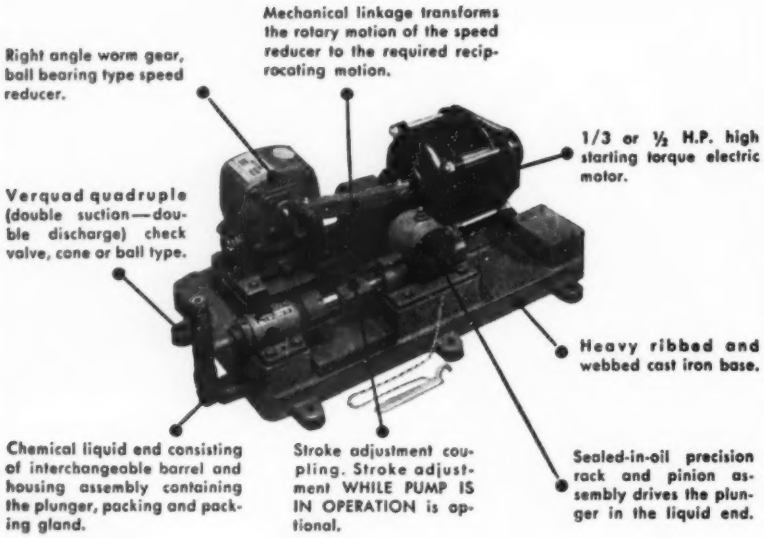
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More TECHNICAL BRIEFS

Begins on page 152

This problem has grown enormously during the last two or three decades because of the tremendous expansion of our industrial potential in the United States. The control of these wastes discharged into the air is not simple, since limitation frequently can be justified only on aesthetic grounds. Demonstration of the danger to human health is not easy because the concentrations of the common contaminants are usually far below the maximum allowable concentrations employed in protecting the plant employee. The three sources of evidence which may be used—(1) the reaction of the workers to much higher amounts, (2) the careful study of unusual instances of extraordinary exposure in the plant or the community, and (3) attempts at correlation with the morbidity and mortality rates of reportable diseases as gathered by the health departments—are discussed in detail.

In each instance these approaches give some help, but even when all can be employed effectively, large gaps remain to interfere with the formulation of adequate control procedures. Since better indices are required, the possible use of field morbidity surveys studying the incidence, prevalence and outcome of human illnesses in clean and polluted areas will be described. Although this approach is costly and time-consuming, it is likely the only method which will furnish the information needed by the health authorities and the industrial engineers in their efforts to answer this question. *MCA Paper, no number.*

Construction of three tiered hydroelectric plants, 260 miles north of Los Angeles, to provide an additional 112,500 kilowatts of electricity for that city, is nearing completion. Each has one unit rated at 37,500 kw. The plants are located in the gorge of the Owens River and utilize the flow of water discharged from Crowley Lake reservoir which has a storage capacity of 183,465 feet. The total average static head from intake to discharge in the river is 2,400 feet. A 230 kilovolt bus connects the three plants and feeds into a single circuit 230 kv transmission line which terminates 260 miles away at Los Angeles.

A 145,000 kw turbine generator—the largest in the Public Service Electric and Gas Co. New Jersey, system and the first of two to be installed in the company's new Kearny Generating Station—was placed in service in March. The second generator will go on the line later this year. The new station is located adjacent to the original Kearny Station which went into service in 1926. The turbine will operate at 2350 psi and 1100 F, with reheat to 1050 F.

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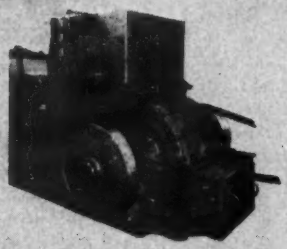

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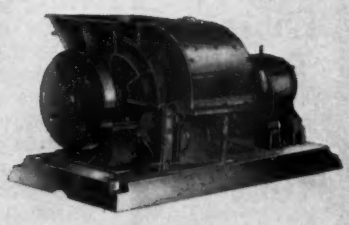

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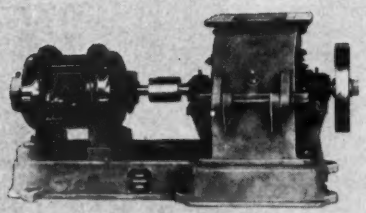

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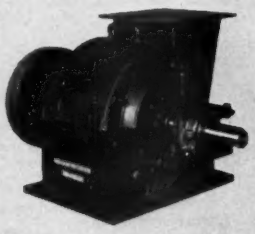

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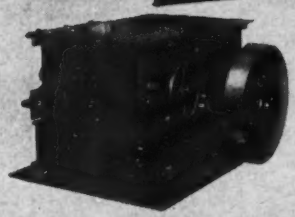

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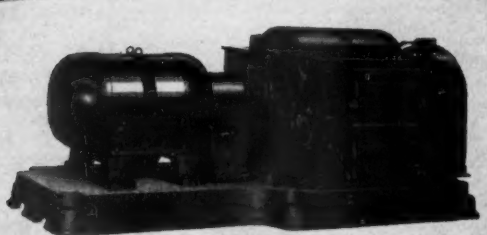

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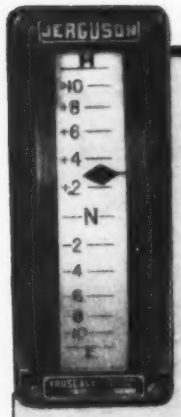

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More POWER NEWS

Begins on page 150

visualized a few years ago," Sporn stated. "Efficiencies of conversion of the heat in fuel into electric energy of the order of 50% are distinct possibilities."

Since crossing the barrier of critical pressures requires new concepts of turbine design, the new Philo plant unit will be a developmental model and will be relatively small as modern generating units go. The 120,000-kw capacity will increase net generating capacity of Philo plant—one of Ohio's largest—to 495,000 kw. The new plant will replace a 40,000-kw unit built in 1923.

The AGE president stated that this new advance will be made available to the entire electric power industry. He promised that, "In conformity with tradition, a more detailed and technical initial description of the development will appear in the industry press within the next few weeks. When the project is completed, it will be described in still greater detail."

Coming Events

Oct 15-17—Second Diesel Operators Conference, University of Nebraska, Lincoln, Neb.

Oct 19-21—Engineers Society of Western Pennsylvania, 14th Annual Water Conference, Hotel William Penn, Pittsburgh, Pa.

Oct 19-23—American Welding Society, National Fall Technical Meeting and Annual Meeting, Hotel Cleveland, Cleveland, Ohio.

Nov 4-6—Industrial Management Society, Third Annual Improvement Contest in conjunction with 17th National Time and Motion Study Management Clinic, Sheraton Hotel, Chicago, Ill.

Sept 14-24, 1954—First International Instrument Congress and Exposition, Commercial Museum and Convention Hall, Philadelphia, Pa.

Atomic Fuel Successfully Bred

BREEDING OF ATOMIC FUEL, long predicted by scientists, is now an accomplished fact, according to the Atomic Energy Commission. Gordon Dean, retiring chairman of AEC, announced this historic accomplishment on June 4th at the Edison Electric Institute meeting in Atlantic City. The reactor testing station at Arco, Idaho, that produced the first useful atomic power in December 1951, has been able to generate more than a pound of plutonium for every pound of uranium 235 burned, he said. Work was under the direction of Drs W Zinn, Lichtenburger and colleagues.

More POWER NEWS on page 220

How **automatic controls** *and* **heating and air conditioning equipment** *work together for best results*

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. . . The unique control requirements of heating and cooling systems

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354 pages, 6 x 9, 200 illustrations, $6.75

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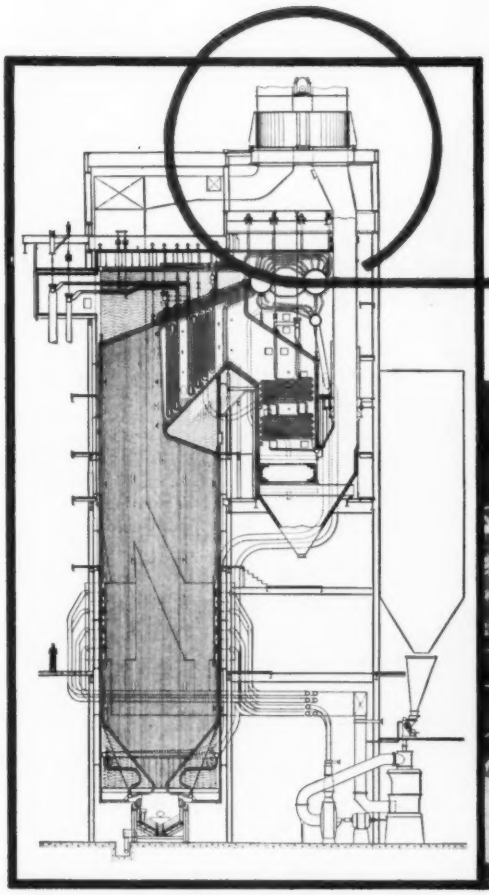
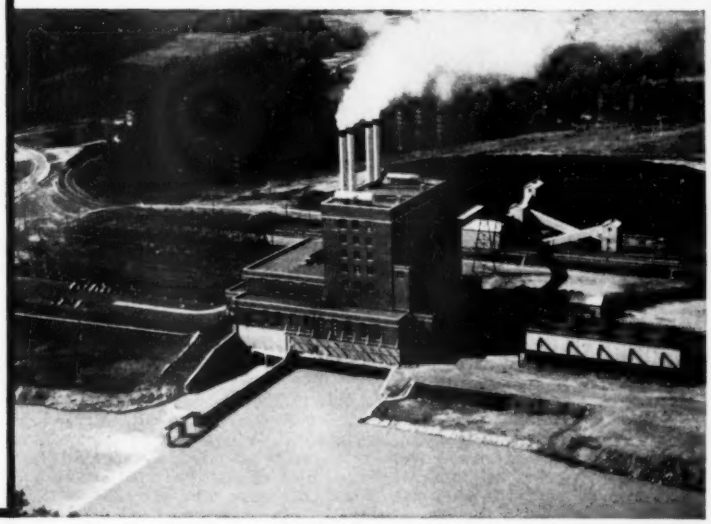


LJUNGSTROM AIR PREHEATERS



By mid-summer last year, both units of the first section of the Duke Power Company's new Lee Station had gone into service. Designed and built by Duke Power's own organization, Lee Station's 190,000 kilowatts help fill the growing power needs of industrialized South Carolina..

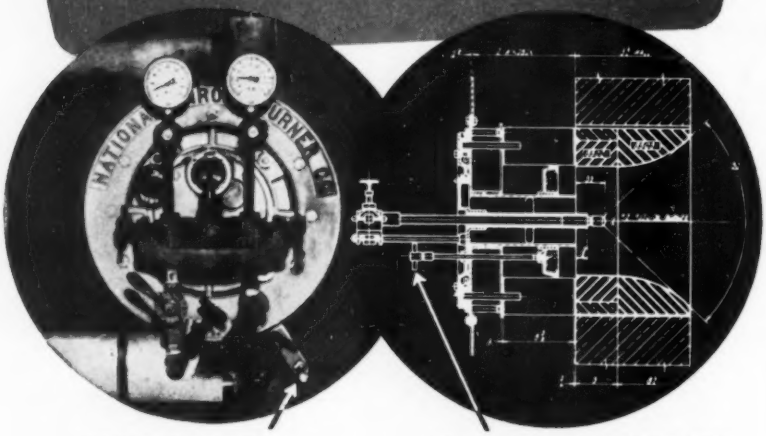
Each of the station's two 90,000/100,000-kw turbine-generators is powered by a boiler designed and built by Combustion Engineering–Superheater, Inc. These C-E Steam Generating Units are fired by pulverized coal, and furnish steam at a throttle pressure of 1250 psi and 950 F, reheated to 950 F.

Two Ljungstrom Air Preheaters are used with each boiler. These Ljungstroms preheat combustion air to 620 F and cool exit gases to 310 F.

Lee Station is another example of the unanimity with which the Ljungstrom Air Preheater is accepted as a standard unit for high-efficiency steam generators. Since the war, Ljungstrom Air Preheaters have been specified for an hourly capacity of over 285,000,000 pounds of steam.

THE Air Preheater Corporation 60 East 42nd St., New York 17, N. Y.

DUAL CONTROL MEANS *Economy...*



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Another "dual advantage" of NATIONAL AIROIL Universal Registers is that they are equipped for dual fuel firing of gas and oil.

Universal Registers with Type "S-A" Burners are available in three (3) sizes . . . capacities up to 60,000 lbs. of steam produced per burner per hour. Write for Bulletin 51.

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More POWER NEWS

Begins on page 150

In itself, the production of new fuel in a reactor is hardly recent. For more than a decade the reactors at Hanford have been consuming U235 to generate plutonium for bombs from U238. However they produced far less than a pound of plutonium per pound of U235. The name "breeding reactor" is reserved for a reactor producing at least one pound of new fuel for each pound of fuel burned. This new fuel, in turn, can be recharged in the reactor to produce another pound of fuel from the U238. Continuation of this process makes it possible to convert the entire charge of fairly inexpensive natural uranium into nuclear fuel equivalent to 1500 tons of coal per pound.

Only one part in 140 of natural uranium is the fissionable fraction U235. So, the achievement of breeding multiplies the effective reserves of uranium *atomic* fuel by 140. On this basis, the world's supplies of available uranium fuel are more than 20 times the world's coal reserves, according to recent estimates.

Dean warned that this cheap and plentiful supply of atomic fuel does not automatically insure cheap power. A large-scale breeder reactor can be a costly proposition. Also the chemical separation processes necessary are costly and complicated.

AEC Adds 12 Firms To Power Study

THE ATOMIC ENERGY COMMISSION has approved addition of 12 companies as associates with Dow Chemical Co and Detroit Edison Co in a joint study of the possibility of developing a nuclear reactor to produce power.

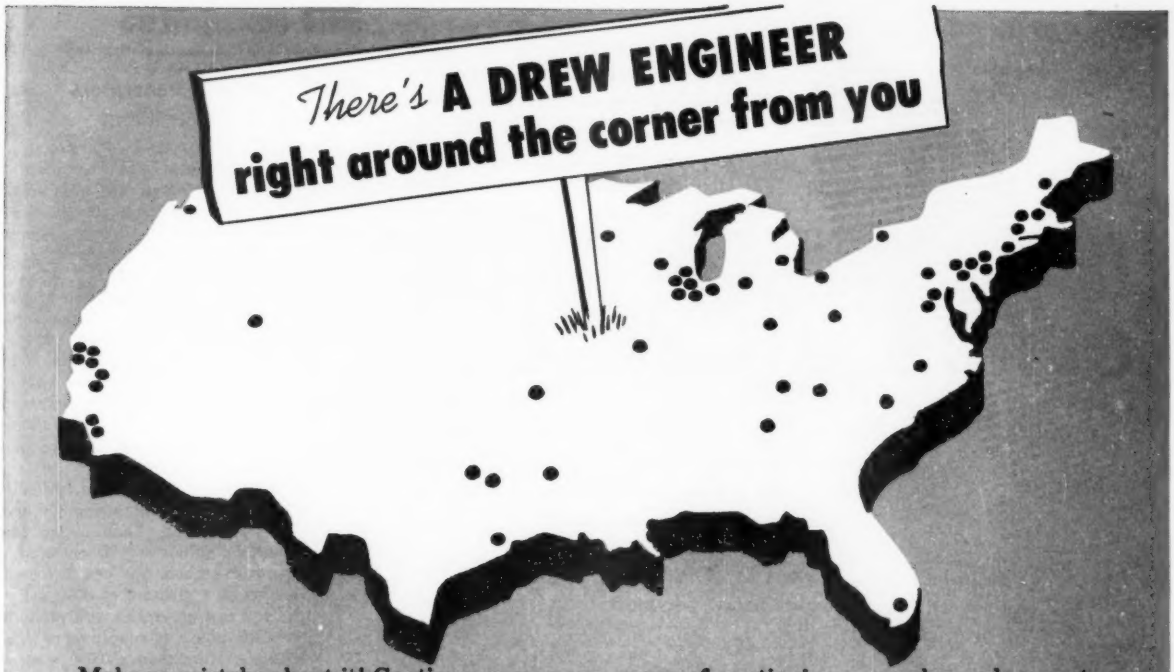
The additional companies are: Consolidated Gas Electric Light and Power Co of Baltimore, Hartford Electric Light Co, Niagara Mohawk Power Corp, Potomac Electric Power Co, Rochester Gas & Electric Corp, Southern Co, Allis-Chalmers Mfg Co, Bendix Aviation Corp, Ford Motor Co, Atlantic City Electric Co, Gibbs & Cox, Inc and United Engineers & Constructors, Inc.

The Dow-Detroit companies will continue to be the primary participants with the AEC but will utilize qualified personnel from the additional companies, as well as personnel from other companies already associated with the project.

Investigations proposed by Dow-Detroit —in keeping with the AEC's own power reactor program—will intensify the improvement of reactors along the lines selected. Estimated at about $1 million in direct costs for 1953, much of the work will be carried on in Dow-Detroit facilities. Research demanding the special facilities of the AEC National Laboratories will be carried out under the direction of AEC personnel.

Other companies that can make a contribution to this project may become associated with it. However, AEC has reserved the right to designate or approve such additional companies.

More POWER NEWS on page 222



Make no mistake about it! Continuous, competent plant service by qualified engineers is a fundamental requirement for efficient boiler water treatment.

Right around the corner from you, there is an experienced water treatment engineer . . . *your* Drew man. And he's backed by Drew's years of continuing research, modern materials and techniques . . . ready to attack and correct your water problems such as boiler scale, corrosion, sludge, carryover.

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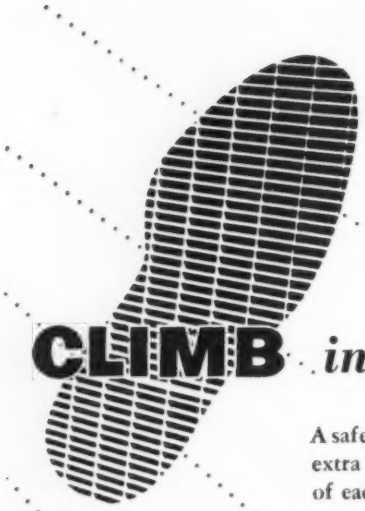

Give your employees another safety plus — install Hendrick Shur-Site Treads for stairs and fire escapes. You cut down accident rates and improve working conditions with Hendrick treads because they afford a non-slipping, level walking surface — have 90% open area, do not obstruct light and ventilation.

CLIMB *in confidence...*

A safety-first, heavy flanged nosing-bar provides extra reinforcement and plainly marks the edge of each step. Bars are square edged, uniformly spaced for long, sustained life.

Ready to bolt directly to stair stringers, they're furnished in standard sizes or in special widths and lengths to meet specific requirements. For more complete data write Hendrick direct.

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Sales Offices in Principal Cities • Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids

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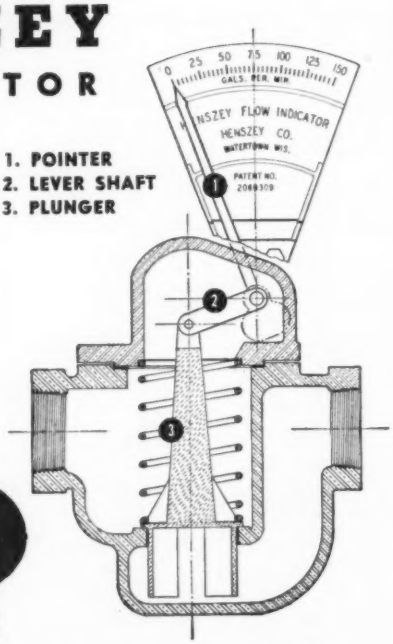
FLOW INDICATOR

There are only three moving parts in the Henszey Flow Indicator—the Pointer, the Lever Shaft and the Plunger. And that means longer wear, continued service, and constant accuracy.

The liquid enters the indicator below the plunger, forcing the plunger upward. Slots in the side of the plunger allow the liquid to pass. Increased flow will increase the lift, exposing a greater area of the slots, so that the life of the plunger is in direct proportion to the rate of flow of the liquid. The graduations on the dial are uniformly spaced from one end to another and read direct — without constants. The entire instrument can be installed right in the pipe line.

1. POINTER
2. LEVER SHAFT
3. PLUNGER



For details consult Sweet's Catalog or write:

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also MILK EVAPORATORS and PRE-HEATERS

More POWER NEWS

Begins on page 150

World's Largest Generators Go to River Rouge Plant

TWO GIANT STEAM TURBINE GENERATORS—the largest in the world—will boost Southeastern Michigan's energy supply by 520,000 kw. The big machines are the first that will be installed in Detroit Edison's new River Rouge Plant. Construction is set to begin in January 1954.

These generators will be of the cross-compound, double-flow, reheat design. General Electric Co and Westinghouse Electric Corp will each supply one of the 260,000-kw capacity units. Their great size is necessary to insure their greatly increased efficiency—each will use less than three-quarters of a pound of coal to make one kilowatt-hour of electricity.

Detroit Edison has also ordered two boilers from Combustion Engineering Co and Babcock & Wilcox Co. Each boiler can produce nearly a million and three-quarters pounds of steam an hour and can deliver it to the turbine at a pressure of 2000 psi.

Each of the new generators will produce enough electric power to supply more than 700,000 people. More than 830,000 tons of coal—enough to heat 105,000 average homes—will be needed each year to supply steam for the turbines. More than 140,000 gpm of water will be used to cool and condense the exhaust steam. This consumption approximates that of a city of 135,000.

Automation Exhibit Starts Country-wide Tour

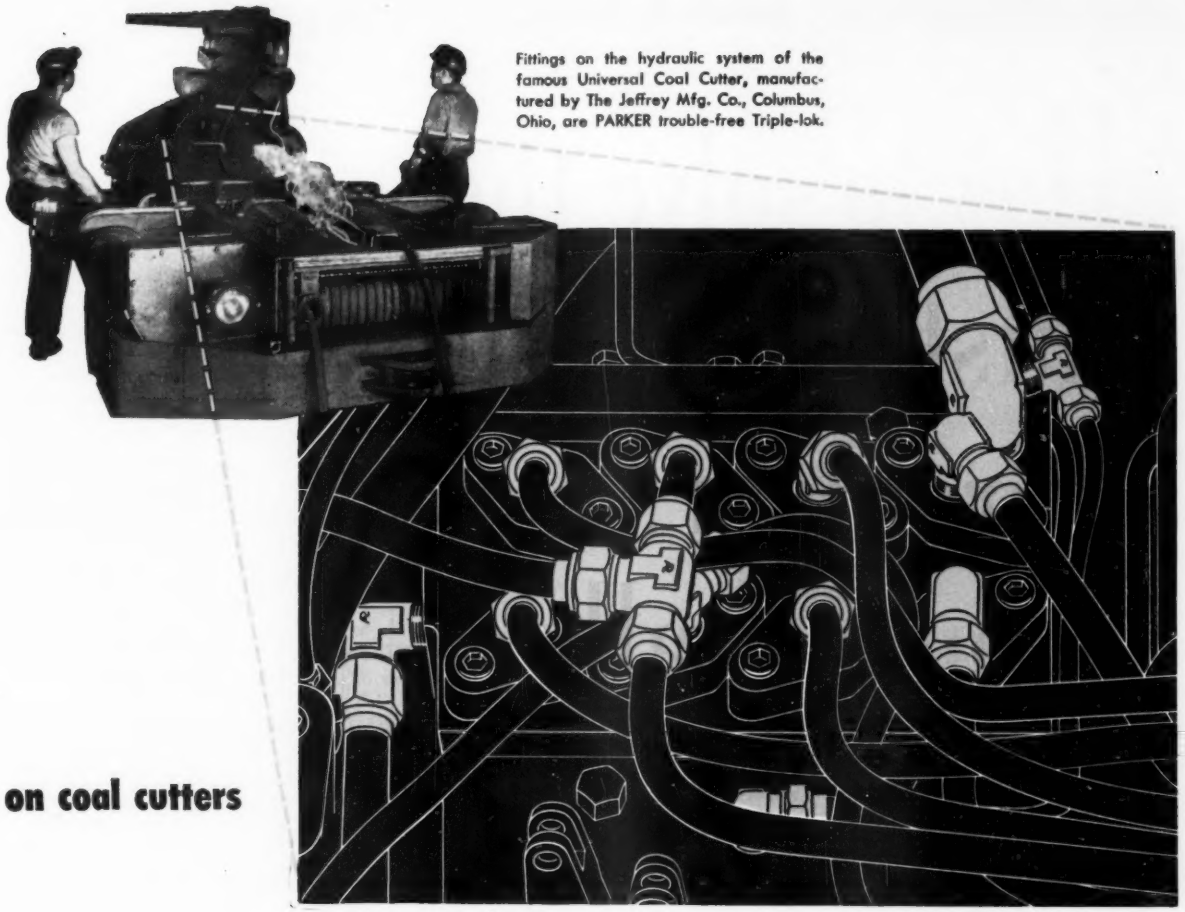
AUTOMATION, one of the hottest industrial subjects today, has been put on wheels by Westinghouse Electric Corp. As the theme of a unique display-coach developed by the standard control division, it is being taken directly to design engineers, maintenance people and supervisory personnel in the machinery manufacturing industry throughout the country.

A mobile combination of the best features of an auditorium and exhibit hall, the coach shows how common electrical devices such as linestarters, control stations, motors, and circuit breakers—the "nuts and bolts" of any electrical system—can be used to achieve successful automation.

Westinghouse takes the coach to the customer's plant and runs consecutive 1½-hr programs for groups of ten to twelve engineers at a time. Highlighting the introductory portion are movies featuring Burnham Finney, editor of *American Machinist*, and Tell Berna, general manager of the National Machine Tool Builders Assn, on the subjects of "Automation Economics" and "Automation Mechanics."

After the first 20-minute portion of the meeting informal presentations are given at each display—many of which are animated to simulate actual factory conditions. These displays are arranged so the engineer gets a progressive picture of the best practices of automation today.

The coach is starting its country-wide tour in the mid-western sector and will make some 350 plant visits over a period of 14 months. The custom-made body of



Fittings on the hydraulic system of the famous Universal Coal Cutter, manufactured by The Jeffrey Mfg. Co., Columbus, Ohio, are PARKER trouble-free Triple-lok.

on coal cutters

Tube it up...Forget it...WITH PARKER

TROUBLE-FREE TRIPLE-LOK FITTINGS

Few machines get rougher use than coal cutters in coal mines. Subjected to severe vibration, caused by the action of the cutting head, and operating under the most adverse conditions, all parts must be ruggedly built, including the hydraulic system.

You'll find Parker Triple-lok Fittings on coal cutters and many other machines used in rough, rugged service because they are leakproof under the severest conditions of vibration, elevated temperatures, high pressures and repeated assembly. Parker Fittings meet the specifications of the A.S.M.E. Code for Pressure Piping, as well as J.I.C. and S.A.E. standards.

So *tube it up* and *forget it* . . . with Parker Triple-lok Fittings. Ask your Parker Distributor for Tube Fitting Catalog 4300, or write The PARKER Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio.

This does it

Triple-lok . . . 3-piece flare fitting famous for its sleeve . . . the easiest way to install tubing systems. Made in brass, steel, stainless steel, aluminum alloy.

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What's more, Buell Dust Collection Systems offer all American industry these further advantages: smoother plant-community relations, improved product quality and higher employee morale.

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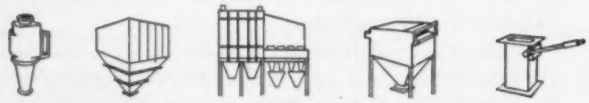


Van Tongeren Cyclone | 'SF' Electric Precipitator | Precipitator-Cyclone Combination | Type 'LR' Collector | Dust Hopper Valves

buell

ELECTRIC CYCLONIC

ENGINEERED EFFICIENCY IN DUST COLLECTION

More POWER NEWS

Begins on page 150

the coach was built by Gerstenslager Co of Wooster, Ohio. Individual exhibits were designed by Gardner Displays Co of Pittsburgh.

Canal Gets Face Lifted

THE PANAMA CANAL is getting its first major overhaul since it was built forty years ago. The first phase of the project, to be completed by 1956, will cost an estimated 1½ million.

Since the opening of the 55-mile canal in 1915, traffic has grown steadily and shutdowns for repairs have increased. According to the board of the Panama Canal Co, necessary overhaul today reduces operating efficiency during five months out of every thirty.

The first part of the two-phase, 10-year plan involves replacement of motor controls costing a quarter-million dollars. Together with repair of the lock culverts, these new controls will shorten the time required to fill and empty lock chambers. Prototypes of the eight types of controls have already been built at the Newark plant of Federal Electric Products Co and delivery of the 398 units—begun in May—will continue through August.

Operation of the six double sets of locks requires 398 motors running on 240-v, 25 cycle alternating current. A control board that is, in effect, a miniature of the locks themselves directs the lifting of the ships.

Water to operate the locks comes from Madden and Gatun Lakes, midway across the isthmus. Roughly 26 million gallons of water—one day's supply for the city of Boston—is poured out to sea in moving one ship through a set of locks. Flow of water is controlled by a series of motor-driven valves, ducts and culverts.

These motors range from 7.5 hp to 70 hp. Their controls consist of reversing combination starters with circuit breaker disconnects and combination reduced-voltage starters with unfused disconnect switches of both reversible and non-reversible types. Overload relays, designed by Federal Electric, will provide positive protection for the canal's specially-designed motors.

Power Behind the Curtain

"HUNDRED" wind-driven generators have been adapted for use along Russian railroad lines, reports *Pravda*, official Communist newspaper. At the same time, *Pravda* charges the USSR ministry of agriculture has failed to take practical action toward using the new generators.

PRAVDA has criticized sharply the USSR Academy of Sciences for failure to organize a hydoelectric institute. The paper charged that the academy has done little development work in the field of large hydroelectric generators and turbogenerators, thereby neglecting matters of extreme urgency for Soviet power engineering.

BULGARIAN electrification progress has been running into serious difficulties. Communist spokesmen announced that poor maintenance, negligence and bureaucratic administration were playing havoc with power supplies. Essential to Bulgaria's in-

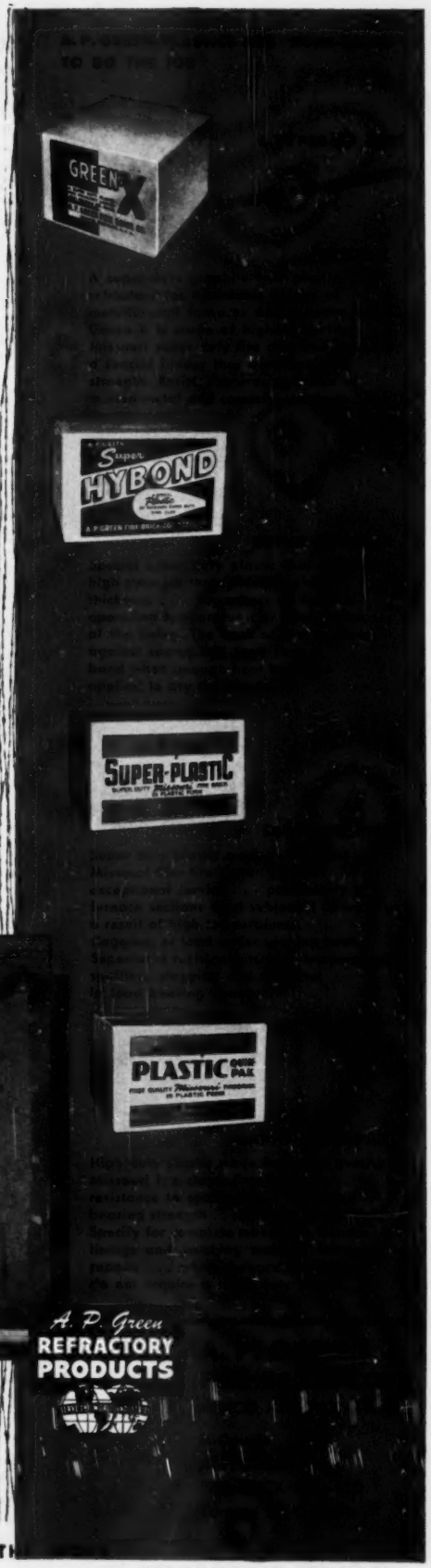
A. P. GREEN

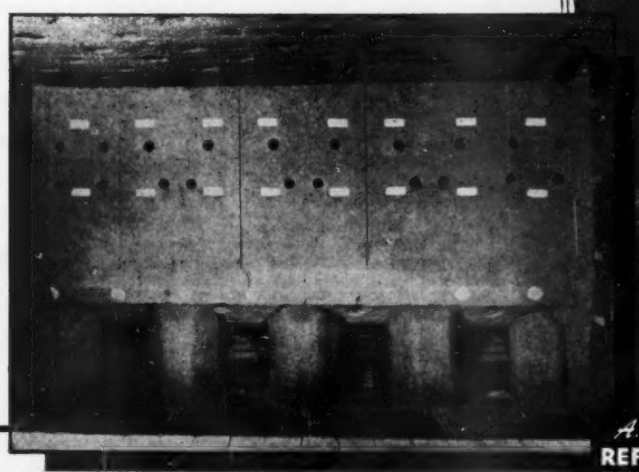
PLASTIC FIREBRICK

GIVES LONGER, TROUBLE-FREE SERVICE

Look at these advantages

1. **Joint-Free Furnace Linings**
   present a solid monolithic front to slag and furnace gases.
2. **Elimination of Air Infiltration**
   lowers fuel cost and increases efficiency.
3. **Adaptable to Any Thickness or Contour**
   eliminating need for special refractory shapes.
4. **Freedom for Expansion and Contraction**
   with A. P. Green floating anchors.





View of monolithic Super-Plastic front wall showing stoker openings, stoker piers, and ignition arch.

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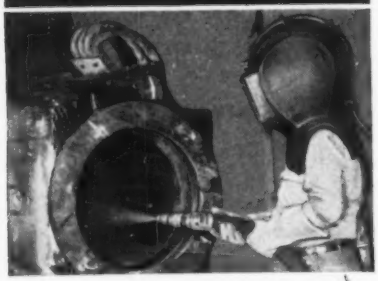
Pangborn's "Corn Grit" AC-4 Blast Machine CLEANS Diesel-Electric Motors WITHOUT SOLVENTS!



SAVES TIME BECAUSE DRYING PERIODS ARE UNNECESSARY!

The Pangborn AC-4 Blast Machine cuts down-time to less than half by *eliminating waiting* for parts to dry . . . by *cleaning faster* . . . by *requiring no dismantling* in most cases. It uses soft 20-mesh corn cob grits to remove dirt, grease, old paint, etc. quickly and efficiently, without harming coils and other delicate parts. Look at these features:

- Cleans in less than half the time of other methods
- Requires no drying periods
- Material costs average 90% less than old-fashioned methods
- Does better job, leaves parts clean and bright
- Eliminates toxic hazards of solvents
- Portable—easily moved from job to job

Write for complete information, telling us what you clean, to: PANGBORN CORPORATION, 90 Pangborn Boulevard, Hagerstown, Maryland.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment.

Pangborn

BLAST CLEANS CHEAPER
with the right equipment for every job

More POWER NEWS

Begins on page 150

dustrialization and modernization of the country's backward rural economy, the electrification program called for a 500-million kwhr increase in power supplies this year.

Human Engineering Institute, stressing practical design problems, will be held the week of August 3, 1953, in Stamford, Conn. Conducted by Dunlap & Associates, Inc, the course will cover principles and methods of equipment design, work place arrangement and work environment improvement—all contributing to safe, efficient operation, simplified selection, training and maintenance, and increased user satisfaction. The course will be limited to about twelve participants. For details, write to Dr Jerome H Ely, Human Engineering Institute, Dunlap & Associates, Inc, Box 1070, Stamford, Conn.

The National Bureau of Standards will adopt a new value for the viscosity of water on July 1, 1953. Following the research of J F Swindells, J R Coe Jr and T B Godrey, 1.0038 centistokes at 68 F has been established in place of 1.0070 centistokes at 68 F—the value currently in use.

The ASTM Committee D-2 on Petroleum Products and Lubricants is preparing the necessary revisions to the viscosity standards and tentatives affected. (D445, D446, D666 and D567.) Method D445-52T will be revised to cover the new value.

Changes in viscosity measurements will be affected, and changes in standards will be necessary. All kinematic viscosity measurements, for example, will be reduced by 0.318%. Saybolt Universal and Furol viscosities, however, will not be affected. Viscosity conversion tables ASTM D-446 and ASTM D666 will require revision.

All kinematic viscometers will require restandardization or recalibration. Viscometers having C-constants that are not simple numbers (0.1, 0.3, 0.5, etc) may be restandardized or recalibrated by multiplying present factors by 0.99682.

The value of secondary standard oils in use by laboratories also will have to be reduced by 0.318%. The National Bureau of Standards will revise the values of the viscosity standard oils they distribute as of July 1, 1953.

A large generator with liquid-cooled conductors, said to be the first in the history of the electrical industry, will be manufactured by General Electric Co, reported Vice-president Glenn B Warren.

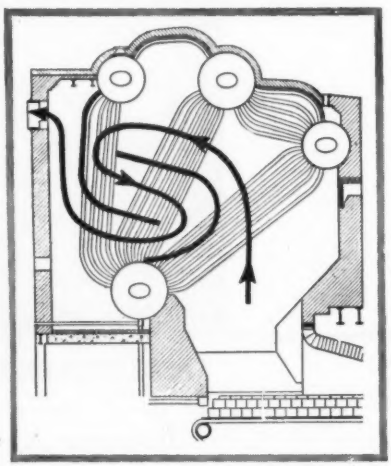
The stator of a turbine-generator set for the new East Lake power plant of Cleveland Electric Illuminating Co will use the new method of circulating liquid through hollow conductors. The unit, consisting of a tandem-compound turbine rated at 208,000 kw and a generator rated at 260,000 kva, will be one of the largest in the world.

This type of liquid cooling makes possible a significant increase in capability of generators without increasing physical dimensions of the units. The higher capability results from more efficient removal of heat produced during generation.

These important fuel-saving, maintenance-reducing features are obtainable with Enco boiler baffles — and *only with Enco baffles.*

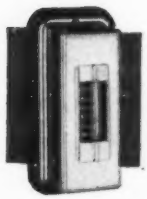
- Streamlined gas flow
- Uniform gas flow
- Elimination of bottle necks
- Reduced draft losses
- Higher heat transfer
- Cleaner heating surfaces
- Less use of soot blower
- Special provision for expansion
- Easy tube replacement
- Adaptable to any water-tube boiler, fired by any fuel

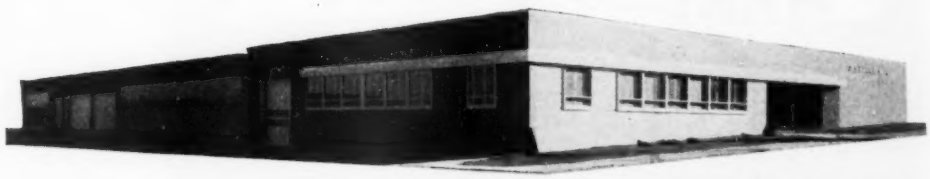
Each application is designed on the basis of more than a quarter century of experience in this specialized branch of power engineering. Installations are made by skilled mechanics.



THE ENGINEER CO.
Enco 75 West St. New York 6, N.Y.

Another Example of the *Adaptability* of JOHNSON AUTOMATIC TEMPERATURE CONTROL





J. J. Hanighen Company, Inc., Office and Warehouse, Omaha, Neb. Noel S. Wallace, architect, Omaha. J. J. Hanighen Company, Inc., mechanical engineers and heating, ventilating and air conditioning contractors.

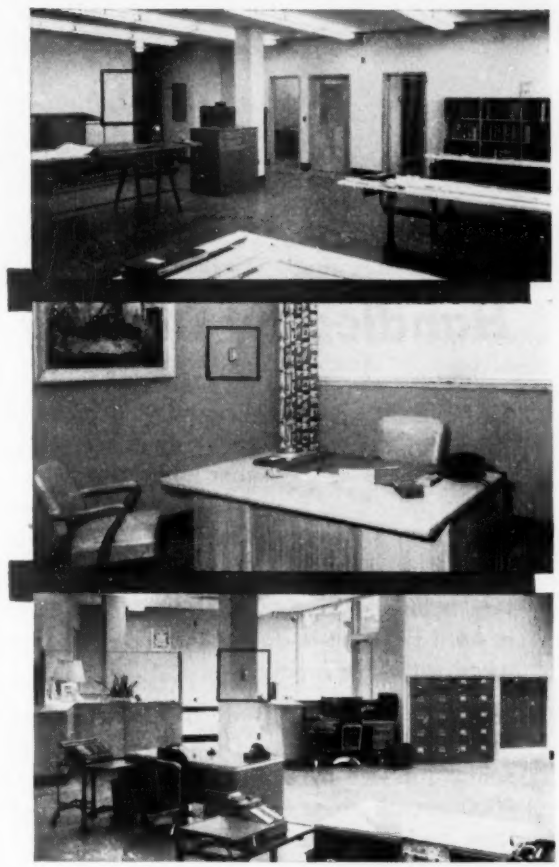
One of the most modern office and warehouse buildings recently constructed is the J. J. Hanighen Company, Inc., plant in Omaha, Nebraska, a firm which specializes in heating, air conditioning, plumbing and power plant installations.

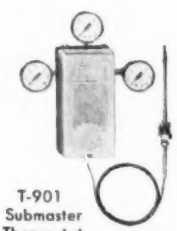
This unusual building is another example of the adaptability of Johnson Automatic Temperature Control. The entire building is heated by radiant panels in floors and outside walls. Johnson Master-Submaster Control, regulating the valve in the steam supply to a hot water converter, supplies hot water to the panels at the exact temperature dictated by the outdoor temperature. Superimposed upon this weather-compensated system are Johnson T-403 *individual room* thermostats, operating Johnson V-149 water valves on the supply to individual panels and providing the optimum in room-by-room comfort and fuel savings.

Behind-the-scenes, Johnson Master-Submaster Control operates Johnson valves and damper operators on the central fan ventilating and air conditioning system which serves the general office, private offices, reception room, conference room and large engineering and drafting room.

All control apparatus is combined in a planned-for-the-purpose, installed-for-the-purpose automatic control system, resulting in maximum comfort and savings for every heating and cooling dollar.

Johnson Automatic Control Systems are designed specifically for each individual installation. Let a Johnson engineer from a nearby branch provide the answer to your temperature control problems. A talk involves no obligation. Ask him to call anytime. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.





T-901
Submaster
Thermostat

T-900 Master
Thermostat

D-251
Piston
Damper
Operator

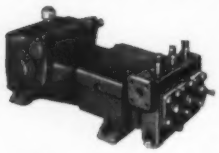
V-149
Water Valve

V-103
Steam Valve

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885

Handled by Deming Pumps



Pumping starch-paste is the job of four Deming Fig. 2993 "Oil-Rite" Horizontal Triplex Pumps in a factory making large paper bags for a wide variety of products. The paste is the adhesive used in sealing the bottoms of the heavy-duty bags.

From three to six months was the maximum life of all pumps used before the Deming "Oil-Rite" Triplex Pumps were installed in April 1951. Up-to-date, all four Deming units have pumped away without a breakdown.

This is one of a multitude of high pressure pumping jobs handled successfully by Deming Fig. 2993 "Oil-Rite" Horizontal Triplex Pumps. Designed for working pressures up to 1000 pounds, these units are built to produce a steady, uniform discharge with practically no vibration.

Ask your Deming Distributor or write us for full details.

THE DEMING CO. • 547 BROADWAY, SALEM, OHIO

DEMING *Industrial* **PUMPS**

BOOKSHELF

The Norton Story *(1953) By Mildred McClary Tymeson. 6x9, 312 pp, illustrated, decorative endpapers, cloth, $3.75. Commonwealth Press, 44 Portland St, Worcester, Mass.*

This is an official history of the Norton Co. But it differs from many such histories, and the key to the difference may be found in the reasoning that led to its publication now, rather than in conjunction with some future anniversary. Today, with many Norton "oldtimers" around and still keen of mind, it was possible to get first-hand accounts of past events and to capture the warm human flavor of early struggles to build a company.

Here then, is the story of a potter's shop that grew into two miles of plant for the production of abrasive materials. Here is the story of the people who made this growth possible. And here, too, is the story of the abrasives industry, for Norton has pioneered many advances in this field.

This book will, of course, have special appeal for engineers concerned with abrasive and refractory products. But it should appeal also to engineers interested in general industrial history and in the way business forces and human character react to create a successful enterprise.

Introductory Engineering Materials *(1953) By Irving H Cowdrey, Assoc Prof Emeritus, Massachusetts Institute of Technology and E L Bartholomew Jr, Assoc Prof, University of Connecticut. 5½x8¼, 424 pp, 124 fig., tables, cloth, $6.00. McGraw-Hill Book Co, 330 West 42 St, New York 36, N. Y.*

Engineers wanting a refresher in properties of the materials they use, or having occasional need for materials information, will find this a handy book. It is concise, readable, and up-to-date enough to describe the latest plastics. Materials covered are: wood, stone, brick, cement and concrete, plastics, irons, steels, alloy steels, light metals and their alloys, copper and its alloys, special-purpose non-ferrous alloys. Chapters also cover processes such as heat-treatment, forming, casting, welding.

Aim of the authors is to tell what these materials are, how they're made, what they can do—all in generally qualitative terms. Their text thus works nicely with the usual handbooks giving quantitative data about materials but little explanatory or background information.

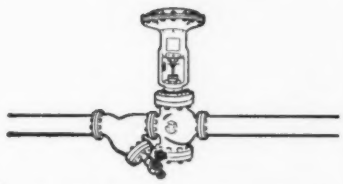
Condenser and Heat Exchanger Tube Handbook *(1953) By Bridgeport Brass Co. 6x9, 156 pp, free to corrosion engineers and users of condenser and heat exchanger tubes. Bridgeport Brass Co, Bridgeport 2, Conn.*

A compact and readable handbook dealing with the properties of copper-base condenser tube alloys and their applications in the chemical, petrochemical, power, marine fields, and processing industries.

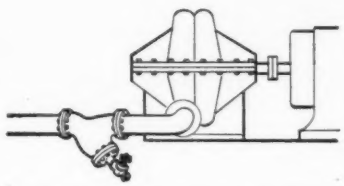
The various types of corrosion affecting tubes from the water side are presented in detail and illustrated with numerous micro-

Which of over 150 Leslie strainers is the one for YOUR job?

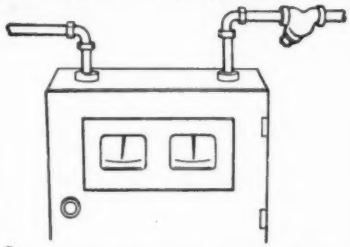
THREE "MUSTS" FOR GOOD PIPING PRACTICE . . .



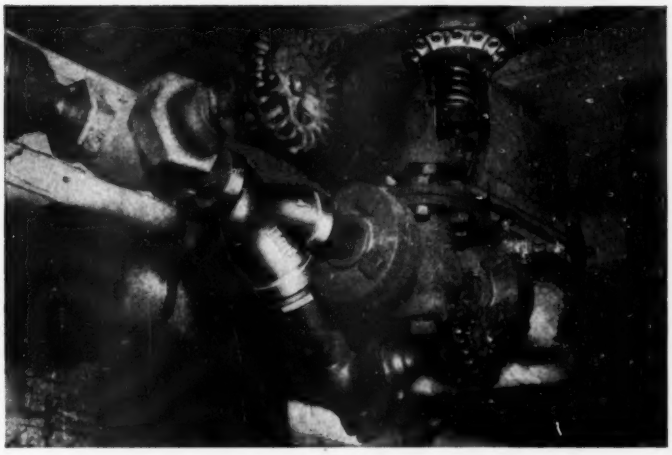
1. **For protection of control valves.**



2. **Protection of pumps, turbines and process equipment.**



3. **For superfine cleaning of air, steam and liquid flows, Leslie "Poromet" filters trap particles down to .001".**



WHICH WILL GIVE COMPLETE PROTECTION AT LOWEST COST?

Just considering strainer body material and screen specifications alone, there are over 150 *standard* combinations of "Y" type Leslie strainers. Each is engineered to do specific jobs under specific conditions . . . there's a "Leslie" for any industrial or marine pipeline strainer application.*

Then, with the myriad of pipe sizes and end connections, it's apparent that picking the right strainer to protect valuable equipment exposed to flow is *not* a "pin-the-tail-on-the-donkey" task.

*There are standard units for pressures to 2500 psi; temperatures to 1050° F; semi-steel, cast bronze, cast steel and cast alloy steel; screwed, flanged, welding or ring-type ends; sizes from ⅛" to 1".

RESERVE YOUR FREE COPY OF 12 PAGE BULLETIN 5308

soon to be released, showing strainer dimensions, pressure drop charts and pressure-temperature limit tables. Reserve your copy today. Write LESLIE CO., 235 Grant Ave., Lyndhurst, N. J.

It costs no more...

to get the right equipment for the right job. In fact, it costs less. It will pay to call your Leslie Engineer before specifying strainers... or any pressure, temperature or level control equipment. He's listed in the classified telephone directory in principal cities—under "Valves" or "Regulators."

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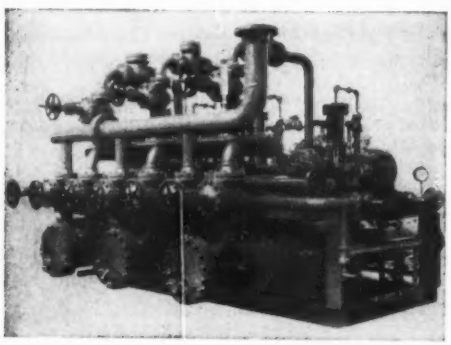
LOCKETT FUEL OIL PUMPING AND HEATING SETS



The compact, high-pressure Unit shown consists of one Turbine-driven and two Motor-driven Pumps, and three Shell-and-tube-type Oil Heaters mounted on a single frame. This Unit is designed to handle a capacity of 50,000 pounds per hour of bunker fuel oil against 400 P.S.I.

Custom Built

For almost a half century, Lockett has been supplying, to fit individual needs, efficient standard and custom-built, Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available: Either two Turbine-driven Pumps; one Electric-driven and one Turbine-driven Rotary Pump; two Electric-driven Rotary Pumps; two Worthington Duplex Steam Pumps; or one Duplex Steam Pump and one Electric-driven Pump. Each pump-and-heater is suitable for the full rated capacity of the unit; the second pump and heater are spares. Lockett supplies everything, complete. Inquiries are invited. *Descriptive bulletins sent on request.*

A. M. LOCKETT & COMPANY, LTD.
Contracting Mechanical Engineers
NEW ORLEANS - HOUSTON - DALLAS - GALVESTON

More BOOKSHELF

Begins on page 228

graphs and charts. Attention is given to Duplex tube combinations of ferrous and nonferrous alloys designed to offset the effects of the two different corrosive media on the outside and inside of tubes.

Other subjects included are: effect of water composition, pH values, dissolved gases, temperature variations, biofouling, inhibitors, steam erosion-corrosion, stress corrosion, etc. Especially helpful is a compact listing of the comparative properties of standard condenser tube alloys.

Pompes, Ventilateurs, Compresseurs, Centrifuges et Axiaux (*Pumps, Ventilators, Compressors Centrifugal and Axial*). *(1953) By A deKovats and G Desmur. 336 pp, 6x9¼, illust, cloth, 3800 Francs. Published by Dunod, 92 Rue Bonaparte, Paris, (VI) France.*

In the main this is a solid treatise of theoretical and design fundamentals of centrifugal machinery. But substantial space is devoted to details of construction, and there is some discussion of centrifugal pumps for special applications.

In America this book will be of interest chiefly to the French reading designers and research men associated with companies building machinery in this general class.

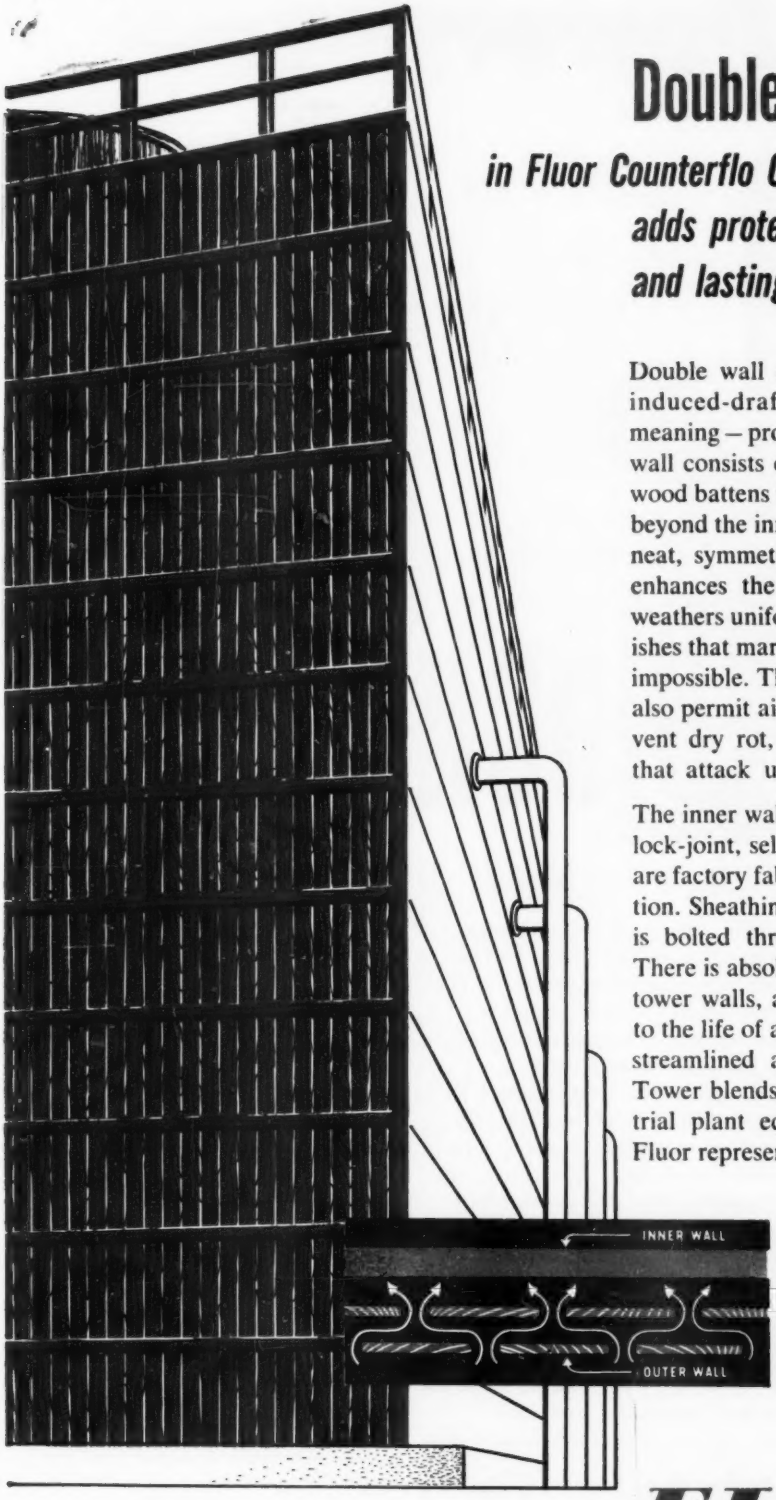
Les Diagrammes Enthalpie - Entropie, Applications a L'air et aux Gaz de Combustion *(Enthalpy and Entropy Diagrams, Applications to Air and Combustion Gases). (1953) By P Chambadal. 50 pp, 8⅜x10⅝, paper bound, plus 3 large foldout charts. 940 Francs. Published by Dunod, 92 Rue Bonaparte, Paris (VI), France.*

This book, with its large charts, will be of value to designers of gas turbines and to others concerned with the thermodynamic properties of air and combustion gases. Contents include discussion of the use of the charts, elementary theory of gas turbines, thermodynamic properties of gas and gaseous mixtures, enthalpy-entropy diagrams for air, combustion, thermodynamic diagrams of combustion gas, etc.

AMERICAN ELECTRICIANS' HANDBOOK. *(Seventh Edition). By Terrell Croft, consulting engineer and revised by Clifford C Carr, Head of Department of Electrical Engineering, Pratt Institute. 7½ x 5, 1773 pp, $10.00. McGraw-Hill Book Co, 330 West 42 St, New York 36, N. Y.*

This latest revision of an intensely practical job-book is in accordance with the 1951 National Electrical Code. It covers the problems met by the construction electrician as well as the man interested in plant electrical operation and maintenance. Although well suited for the embryo electrical man it would be a fitting addition to the seasoned electrician's library.

Besides covering all the basic electrical jobs such as signal wiring, branch circuit wiring, etc, the book includes authoritative information on such subjects as electron tubes, and circuits, fundamentals of electrical construction, operation and application of electronic devices in industry, electronic control of motors, automatic electric drive controls, dry-type rectifiers, unit-substation distribution systems, etc.



Double wall sheathing

in Fluor Counterflo Cooling Towers adds protection and lasting good looks

Double wall construction provided on Fluor induced-draft cooling towers has a double meaning – protection and beauty. The outer wall consists of a double row of vertical Redwood battens which are located four inches out beyond the inner wall. This protective casing is neat, symmetrical, eye appealing and greatly enhances the beauty of a cooling tower. It weathers uniformly. Unsightly stains and blemishes that mar a cooling tower's appearance are impossible. The equally spaced rows of battens also permit air circulation around walls to prevent dry rot, algae growth and other blights that attack unventilated cooling tower walls.

The inner wall is constructed from 1 x 6 full Z lock-joint, select "heart" Redwood. Both walls are factory fabricated into panels for easy erection. Sheathing is not nailed to outer posts but is bolted through the main tower columns. There is absolutely no structural load borne by tower walls, another factor which adds length to the life of a Fluor Cooling Tower. The neat, streamlined appearance of a Fluor Cooling Tower blends well with today's modern industrial plant equipment. Contact your nearest Fluor representative, or write for details

Top view of double wall. The uniform spacing of vertical battens is not for the sake of appearance alone. Air is permitted to circulate between the aerators to prevent dry rot and living organisms from attacking tower walls.

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HERE'S ONE GOOD ANSWER ⇩

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Mono-Block

There's more to insulation than heat *savings.* Insulation also makes heat easier to *control.* But what type is needed to help produce maximum results? B-H MONO-BLOCK is one good answer because it is effective over the full temperature range to 1700° F. . . . is used on steam boilers, tanks, towers, ovens and similar equipment where accurate control is essential to efficient operation. B-H MONO-BLOCK of fibrous rockwool provides stability under severe temperature and moisture conditions. It is light and easy to handle—and readily cut into straight or irregular shapes for speedy application. If you have any problems involving heat conservation or control—consult our Engineered Insulation Service.

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Please send complete information on

- ☐ MONO-BLOCK . . . Rigid, felted black rockwool block—for high and low temperature use
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- ☐ BLANKETS . . . Metal-reinforced, flexible, felted black rockwool insulation
- ☐ NO. 1 INSULATING CEMENT . . . All-purpose, rust-inhibiting plastic cement

More FREE BULLETINS

Begins on page 166

14 **Inductrol power packs** for ac lighting and power service up to 112.5 kva, 600 v and below. 8-page illustrated Bulletin GEA5928. General Electric Co, Schenectady 5, N. Y.

15 **Manual and magnetic motor starters** in 2, 3, 4 poles for single, 2, 3 phase 4-wire systems. Bulletin 404, 4 pages with photos and dimensions. Federal Electric Products Co, 50 Paris St, Newark 5, N. J.

ELECTRICAL EQUIPMENT

16 **Wiring diagrams** showing standard and specialized wiring for all size starters on 1, 2, 3 phase systems. Bulletin 709, 22 pages. Allen-Bradley Co, Milwaukee, Wis.

17 **Relays and contractors** for every electrical and electronic use—power, multiple contact, multiple leaf, impulse, space saver, telephone, etc. Catalog 122, 24 pages of pictures, schematic drawings, data charts. Potter & Brumfield, Princeton, Ind.

18 **Wire and cable:** 76-page booklet, "U.S. Electrical Wires and Cables for the Chemical and Petroleum Industries." Electrical Wire and Cable Dept, U.S. Rubber Co, Rockefeller Center, New York 20, N. Y.

19 **Gear-motors:** function, design, application and maintenance of gear-motors of 1/6 to 200 hp. Bulletin GEA-1437H, 15 pages with cutaway photos and tables. General Electric Co, Schenectady 5, N. Y.

20 **Flexible electrical conduit** with galvanized steel core, positive ground, synthetic covering to protect wiring. Bulletin UA-530, 4 pages with photos. American Brass Co, American Metal Hose Branch, 692 Main St, Waterbury, Conn.

21 **Weather-protected motors** of 250 hp and larger. Base-ventilated and grade-mounted. Bulletin GEA-5810, 4 pages with photos, diagrams, tables. General Electric Co, Schenectady 5, N.Y.

22 **New housing circular** covers specific applications of steel, brass, copper or aluminum housings. Olympic Metal Products Co Inc, Alpha, N. Y.

23 **Electromagnets and magnet controllers:** weights and capacities of standard bolted, welded, basket type magnets. Bulletin 112, 6 pages with photos and tables. Ohio Electric Mfg Co, 5400 Dunham Rd, Cleveland, Ohio.

24 **Catalyst battery cap** uses palladium to recombine battery gases with water. Technical bulletin with diagrams and references. Industrial Research Inc, 4016 NW 29th St, Miami 42, Florida.

MAINTENANCE AND SAFETY EQUIPMENT

25 **Blast cleaning hose machines** for hand-operated, industrial cleaning jobs described in Bulletin 100A. 24 pages with photos, diagrams, tables. Pangborn Corp, Hagerstown, Md.

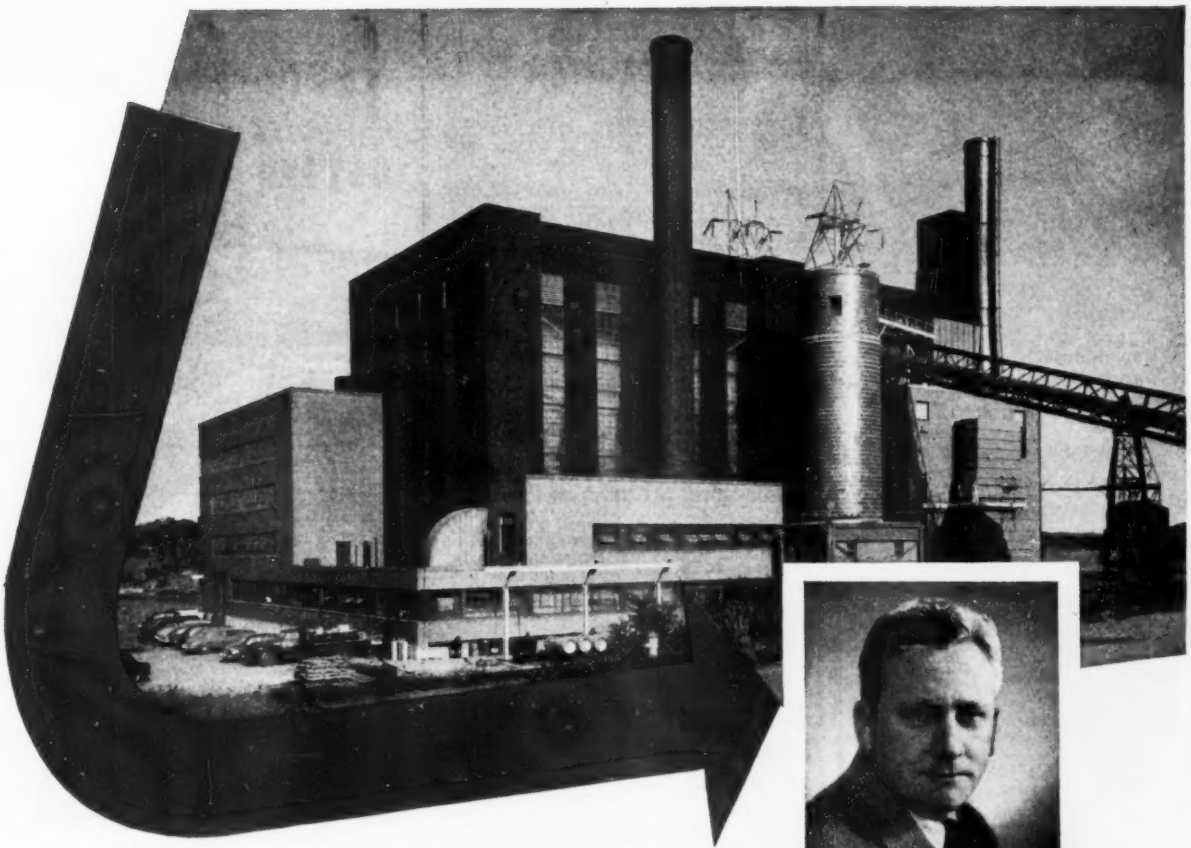
26 **Industrial signs** covering accident prevention, directional and general information, parking and traffic control, etc. 4-page price list. Eastern Metal of Elmira Inc, 120 Harrison St, Elmira Heights, N. Y.

27 **Rotary stands** for storing small parts described in 3-page illustrated folder MH-810. Union Metal Mfg Co, Canton 5, Ohio.

28 **Streamlined lubrication program** using only six lubricants described in 10-page illustrated booklet "How to Simplify and Save with Pure Industrial Lubricants." Pure Oil Co, 35 E Wacker Dr, Chicago 1, Ill.

MATERIALS HANDLING

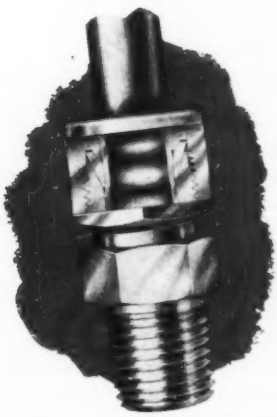
29 **Dump bodies and hoists** for installation on trucks and trailers. Heavy-duty units featured in illustrated Bulletin HB302. Customer Service Dept.



© Fabian Bachrach

Fred Moran
Midwest Piping & Supply
Company, Inc.

"We've found that 'soaping' Swagelok Tube Fittings is just a waste of time..."



Schiller Station (pictured above) of Public Service Company of New Hampshire, at Portsmouth, is equipped with Swagelok Tube Fittings installed by Midwest Piping & Supply Company, Inc.

Mr. Fred Moran, job superintendent for Midwest, says, "A routine practice with us is to 'soap' each joint after the original installation to determine whether any fittings leak. We tested all Swagelok Fittings as a matter of course but not a leak showed up; so this operation will be eliminated on future installations. Results were so favorable that *we've found that 'soaping' Swagelok Tube Fittings is just a waste of time...*"

Passing extraordinary as well as ordinary tests is a specialty of Swagelok Tube Fittings. For example, on Ultra-High Vacuum applications, Swagelok Fittings commonly are used in the range of 10^{-7} millimeters of mercury.

Swagelok catalog on request. Address Department 97.

COME TO YOU COMPLETELY ASSEMBLED, FINGER TIGHT

TWO HEADS ARE BETTER THAN ONE
TWO FERRULES ARE BETTER THAN ONE
TRADE MARK

SWAGELOK FITTINGS AVAILABLE IN: BRASS, ALUMINUM, STEEL, STAINLESS STEEL, MONEL

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Catawissa PERFECT SEAL Unions

HOT FORGED from solid, rectangular steel bars, designed and produced for dependable, long-life service under the severest piping conditions!

A TYPE FOR EVERY USE!
FOR ALL PRESSURES!
FOR ALL TEMPERATURES!

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Available with screwed or socket weld ends. 3000-lb. sizes ⅛" to 3"; 6000-lb. sizes ⅛" to 2".

ORIFICE UNIONS

With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

MALE & FEMALE UNIONS

With steel-to-steel, bronze-to-steel, stainless steel-to-steel or orifice seats. 3000-lb. service only.

FULL STAINLESS & FULL ALLOY STEEL UNIONS

With screwed or socket weld ends. 3000-lb. and 8000-lb. service.

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showing the complete Catawissa line of Perfect Seal products

CATAWISSA VALVE & FITTINGS COMPANY
206 MILL ST. • CATAWISSA, PA.

More FREE BULLETINS

Begins on page 166

Gar Wood Industries, Wayne, Mich.

30 **Industrial slings** with tensile strength of 1000 lb to 243.4 tons shown in illustrated 4-page folder 5308. Macwhyte Co, Kenosha, Wis.

31 **Magnesium ramps** for car and truck loading operations. More than 70 standard sizes to meet all loading conditions in the 3000 to 10,000 lb range. Penco Engineering Co, 25 California St, San Francisco 11, Calif.

32 **Electric industrial trucks** and transporters with capacities from 2 to 8 tons. Driver-led units. Bulletins 1003 and 1009. Automatic Transportation Co, 149 W 87th St, Chicago 20, Ill.

33 **Gravity conveyors** with steel frame and aluminum wheels described in single page bulletin. Prices, weights, capacities, construction features included. Rapids-Standard Co, Inc, 342 Rapistan Bldg, Dept A-S, Grand Rapids 2, Mich.

MECHANICAL TRANSMISSION

34 **Worm reduction gears** in ratios of 5 to 1 through 100 to 1 and from fractional to 400 hp. Fan-cooled units, illustrated catalog R-103. Rockwood Pulley Mfg Co Inc, 20 Crosby St, New York 13, N. Y.

35 **Sheaves and hubs** specifications guide with cutaway and section diagrams. Catalog section 83, 6 pages. Fort Worth Steel and Machinery Co, Fort Worth, Texas.

36 **Conveyor and elevator belting** installation and maintenance described in 32-page illustrated manual. B F Goodrich Co, Akron, Ohio.

37 **Hydraulic puller** manual covers removal and installation of gears, pulleys, sheaves, pinions, shafts, etc. by hydraulic power. Bulletin HY-1953. Owatonna Tool Co, 378 Cedar St, Owatonna, Minn.

38 **Sprocket installation and removal** instructions, specifications, etc. covered in 2-page illustrated folder. Catalog J-1. Union Chain and Mfg Co, Sandusky, Ohio.

39 **Belt conveyor carriers** described in 2-page illustrated folder. Bulletin 453. Stephens-Adamson Mfg Co, Aurora, Ill.

METALS AND ALLOYS

40 **Mechanite castings** described in 8-page folder. Properties and specifications included. American Brake Shoe Co, 230 Park Ave, New York 17 N. Y.

41 **Principles of heat treatment,** a 43-page booklet covering annealing, hardening, martempering, austempering and surface hardening. Numerous charts and diagrams. Mechanite Metal Corp, 714 North Ave, New Rochelle, N. Y.

42 **Standard castings** in iron, semi-steel and non-ferrous metal. No patterns required, delivery from stock. Myerstown Foundry and Machine Works, Box 296, Myerstown, Pa.

METERS AND INSTRUMENTS

43 **Photoelectric reflection meter** Model 610 with new accessories presented in Bulletin 605. Photovolt Corp, 95 Madison Ave, New York 16, N.Y.

44 **Time deviation recorder** keeps indicated time standard within a fraction of a second. *Electronik* Data sheet 9.1-14. Minneapolis-Honeywell Regulator Co, Sta 64, Wayne and Windrim Aves, Philadelphia 44, Pa.

45 **Metameters and telemeters** for recording and controlling pressure, liquid level, voltage, temperature etc. Bulletin M1710, 42 pages with photos, charts, wiring diagrams. Bristol Co. Waterbury 20, Conn.

46 **Half-second electronic recorder** measures output of any primary

Ferri-Floc WAY IS A BETTER WAY!

You Can Expect These Advantages With Ferri-Floc-

1. Rapid Floc Formation	5. Bacterial removal
2. Taste and odor control	6. Manganese and Silical removal
3. Color removal	7. Turbidity removal
4. Ease of operation	8. Economy

Ferri-Floc has the ability to coagulate waters and wastes over wide PH Ranges and will provide excellent flocculation in softening systems.

SULPHUR-DIOXIDE HIGHEST QUALITY **SO_2**

SULPHUR-DIOXIDE is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.

COPPER TC SULPHATE

COPPER SULPHATE will control about 90% of the micro-organisms normally encountered in water treatment plants more economically than any other chemical.

Free literature!
—Send card or letter to Tennessee Corp., Grant Building, Atlanta, Georgia

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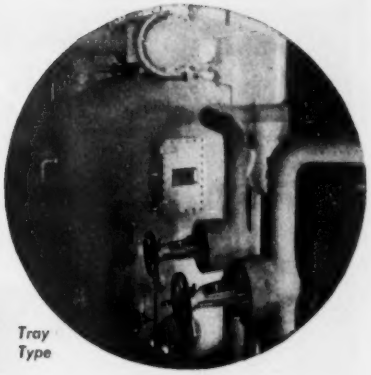
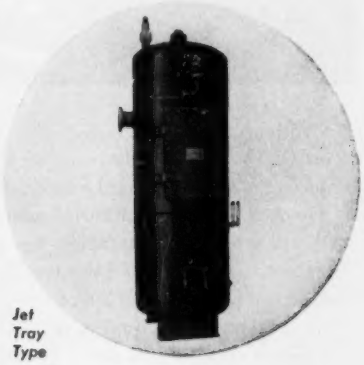
617-29 Grant Building, Atlanta, Georgia

DEAERATOR TYPES FOR ALL SERVICE REQUIREMENTS

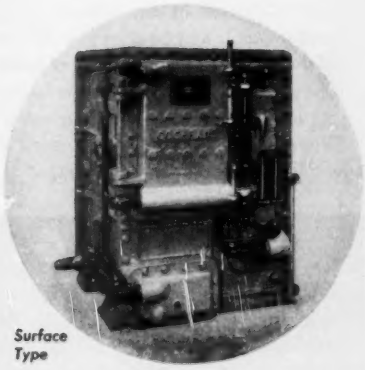


Tray Type

Atomizer or Spray Type



Jet Tray Type



Surface Type

HAVE YOU PROBLEMS OF: CORROSION? FEED WATER HEATING? DEAERATION?

Call Cochrane. Whether your plant is large or small, the *unbiased* recommendations of Cochrane Engineers will assure the correct selection of equipment for your particular operating conditions. As specialists in the field of Deaeration, Cochrane originated the jet tray and atomizing principles and designs and manufactures all types of Deaerating equipment—Tray, Jet Tray, Atomizer or Spray, and Surface—in all sizes, all materials.

Over 90 years of specialized experience in water conditioning are at your service when you call a Cochrane Engineer. Write for the address of our office nearest you. We'll be happy to discuss your requirements without obligation.

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In Canada: Canadian General Electric Co., Ltd., Toronto
In Mexico: Babcock & Wilcox de Mexico, S. A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris
In Cuba: Laurence E. Daniel, Inc., Havana
In South America: Servicios Electricos, C.A. (S.E.C.A.) Caracas, Venezuela
In Puerto Rico: F. A. Ortiz & Co., San Juan 5

Hot Process Softeners • Deaerators • Dealkalizers • Demineralizers • Reactors • Continuous Blow-Off • Specialties • C-B Systems

Although designed primarily for use on lead covered cable installed in ducts, Biddle Cable Fault Locators are also used on aerial and buried cable. The new Model 4 Transmitter has a maximum output of 15 kv d-c and a discharge capacitance of 2 muf.

The Model 4 Transmitter requires a source of supply of about 600 va at 115 volts a-c and weighs about 150 lbs. complete with all test leads. Unit can be carried in any ordinary passenger car. It may be used as a source of d-c voltage for proof testing of cable and other insulation, a very valuable feature both at installation and after alterations or repairs. It provides a d-c over-voltage test facility that is particularly suited to cables and other electrical apparatus in the lower voltage classes. It has a maximum proof testing current capacity of 15 milliamperes at about .7 megohms and about 50 milliamperes at short circuit.

The Model 4 Transmitter is a strongly built unit equipped with the highest quality components available, and designed for hard service. The structural parts are a combination of steel and aluminum with the exterior finished in grey enamel hammertone finish.

For complete information on Biddle Cable Fault Locator equipment, write for our new **BULLETIN 65-P.**

B-932

JAMES G. BIDDLE CO.

• ELECTRICAL TESTING INSTRUMENTS
• SPEED MEASURING INSTRUMENTS
• LABORATORY & SCIENTIFIC EQUIPMENT

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PHILADELPHIA 7, PA.

More FREE BULLETINS

Begins on page 166

device producing an emf of 3 mv. Data Sheet 10.0-13. Minneapolis-Honeywell Regulator Co, Sta 64, Wayne and Windrim Aves, Philadelphia 44, Pa.

47 **Automatic moisture tester** utilizes Karl Fischer "dead-stop" reaction for water measurements in titrations for moisture. Data File 307-235 Beckman Instruments Inc, South Pasadena 1, Calif.

48 **Gage protector** automatically cuts off pressure line when it exceeds gage capacity. Available for all standard gages from 15 to 5,000 psi. Complete valve and specialty catalog obtainable from Republic Mfg Co, 1930 W 77th St, Cleveland 2, Ohio.

PIPING, VALVES, FITTINGS, SPECIALTIES

49 **Repair clamps and saddles** for steel and cast iron pipe described in 27-page catalog 41-0. Photos and specifications included. M B Skinner Co, South Bend, Ind.

50 **Thermostatic traps** for all industrial applications. Bulletin 1-52, single-page leaflet with diagrams and specifications. Sterling Engineering & Mfg Corp, 117 Business St, Hyde Park 36, Boston, Mass.

51 **Wire thread inserts** of stainless steel or phosphor-bronze protect tapped threads in metal or wood. Bulletin 661, 2-color leaflet with photos showing wide range of available sizes. Heli-Coil Corp, 1321 Shelter Rock Lane, Danbury, Conn.

52 **Ball-type, full-flow valves** offer unrestricted flow, do not leak after continued service. Brochure. Rockwood Sprinkler Co, Worcester 5, Mass..

53 **Air and hydraulic power** applications described. Booklet also displays condensation of complete line of over 400 valves and cylinders. Rivett Lather & Grinder, Inc, Brighton 35, Boston, Mass.

PUMPS

54 **Turbine - type and centrifugal pumps** for water supply, filtering, booster service, brine circulation, etc. 11-page catalog with photos, drawings, specs. Aurora Pump Co, Aurora, Ill.

55 **End-suction, centrifugal pump** in capacities up to 1000 gpm, heads to 400 ft. Bulletin WQ-214, 2 pages with photos, cutaways, specifications. Warren Steam Pump Co, Warren, Mass.

56 **Motor and centrifugal pump** unit is magnetically driven, requires no mechanical seals or stuffing boxes. Bulletin G-1000, 2 pages with photos, cutaways, performance charts. Chempump Corp, 1300 E Memraid Lane, Philadelphia 18, Pa.

WATER TREATMENT

57 **Strainers** for working pressures up to 1500 psi described in 4-page bulletin 200. Photos, diagrams, complete specifications. Sheffler-Gross Co, Philadelphia 6, Pa.

58 **Filters** for hydraulic oils, coolants, lubricants. Catalog 106, 12 pages with cutaways, parts lists, specifications for *Synclinal* units. Marvel Engineering Co, 625 Jackson Blvd, Chicago 6, Ill.

59 **Mono-column demineralizer** mixes cation and anion exchangers in single unit tank through which water passes only once. Illustrated leaflet with parts description and specifications. Penfield Mfg Co Inc, 19 High School Ave, Meriden, Conn.

★ **Conditioning water** for boiler, process and general use described in 20-page booklet. Features zeolite water softener of "double-check" design and deionizer of single-tank design. Data on filters, purifiers, degasitors, etc. Bulletin 611A, photos, cutaways, diagrams. ★Request direct on company letterhead to Elgin Softener Corp, Elgin, Ill.

TERRY

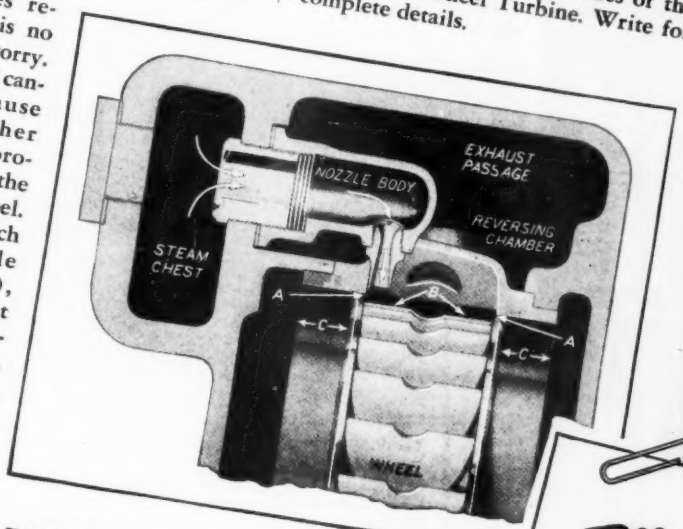
LARGE CLEARANCES take the "worry" out of Turbine Operation

In a Terry Solid-wheel Turbine the power-producing action of the steam in the wheel takes place on the curved surfaces at the back of the buckets. This unique design permits unusually large blade clearance—see B in the diagram.

Even if this clearance becomes reduced, there is no real cause for worry. The blades still cannot foul because they are further protected by projecting rims at the sides of the wheel. These rims, which also have ample clearances (AA), will take without damage any rubbing that may occur.

Side clearance, CC, is so large that end-play from external thrust will not damage the wheel. This clearance is one inch or even greater.

Large side and blade clearances are only two of the many features of the Terry Solid-wheel Turbine. Write for complete details.



THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1191

Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

Two Stage CRUSHING IN ONE MACHINE!

The GUNDLACH "Two Stage" Coal Crusher incorporates two crushing stages in one machine and is designed to reduce RUN-OF-MINE to STOKER COAL in ONE operation. Compact design simplifies structural supports and installation. Rugged simple construction combined with engineering proved in the field makes this machine a profitable and reliable unit.

Fulfilling an urgent need in the industry, the GUNDLACH "Two Stage" Crusher has delivered over 85% stoker coal from an Illinois mine run lot.

All Gundlach Crushers are equipped with Gundlach Patented Crushing rollers. (Pat. No. 2578540)

MATERIAL SIZE CAN BE CHANGED WHILE MACHINE IS RUNNING

Crusher is pictured without hopper and sprocket guards, but is delivered complete.

TWO STAGE — DOUBLE ADJUSTment

WRITE TODAY FOR CRUSHER BULLETIN P-3

T. J. GUNDLACH Machine Co., Belleville, Ill.

My Biggest Boner

► I'm not a lazy guy but at times I like to take a shortcut on my job. Every time my attempts backfire I regret the short cut. But that's human nature."

Our plant has three 200-psi 40,000-lb-per-hr oil-fired boilers with manual soot blowers. I-d fans are turbine-driven. During day shift we run two or three boilers, depending on load. At night we run only one, keeping another warm and at 5 psi as standby.

The night of my famous short cut I guess I might have felt a trifle lazy because when it came time to blow tubes in the standby boiler I didn't bother to open the uptake damper wide or speed up the i-d fan, as the chief instructed.

One burner with a low-capacity tip was in use in the standby boiler. I blew tubes and later learned the burner went out—probably from the steam trapped in the furnace. As soon as I finished blowing tubes there was a dull booming noise and bricks came flying through the air from somewhere overhead.

Oil that collected on furnace floor while burner was out had ignited with explosive suddeness, lifting the refractory roof several inches. Boiler room was covered with a layer of soot.

Repairs cost our company about $4500 and boiler was out of service two weeks. But the big lesson I learned from the boner was: Don't take shortcuts in operating procedures set up by people who know what they're doing.

SAM MELDEN *New York, N. Y.*

• What is your "biggest boner"? We'll pay ten dollars for each one we publish.

Sweden's largest water power station will be built on the Ume River, above the northeastern port city of Umea, on the Gulf of Bothnia. Work will probably begin in the fall. The new plant will be named Stornorrforsen and will have a generating capacity of 375,000 kilowatts.

FREE...

for the asking

GET IT!!

IF you are responsible for the efficient operation of air conditioning equipment, send for a FREE copy of this handy little booklet.

It tells you what to do about lime scale. How to get rid of it. How to prevent it from forming. And the booklet discusses that other enemy of efficiency . . . slime. Describes simple, low-cost ways to prevent it from fouling up lines, tanks and spray jets.

Other items of interest: Cleaning finned coils of air washers, cleaning aluminum plates and screens, descaling cold diffusers, cleaning filter screens.

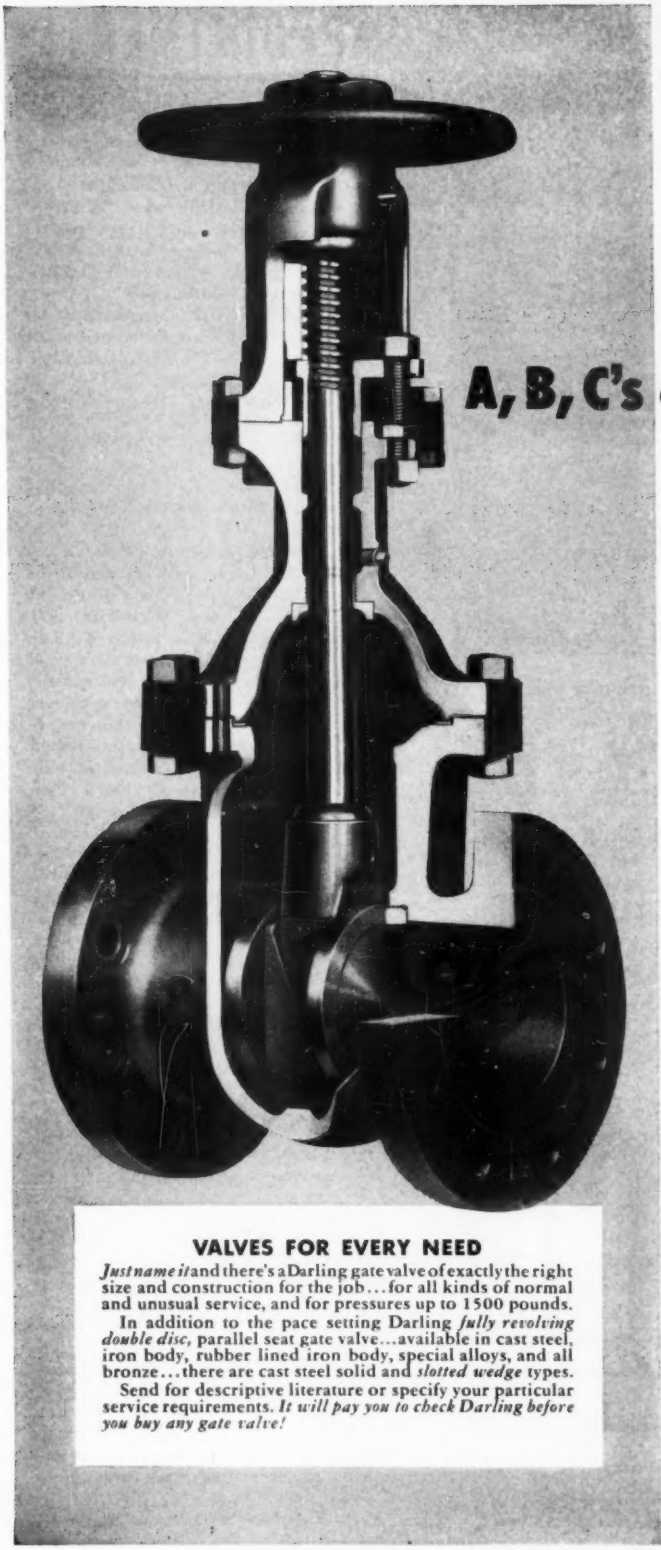
For your free copy, simply drop us a line TODAY. Oakite Products, Inc., 18A Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

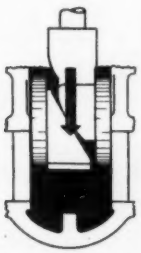
MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada



DARLING VALVES

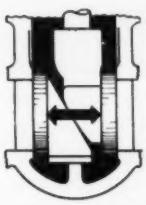
A, B, C's of better valve service with DARLING Revolving Disc GATE VALVES



GATE DESCENDING

A EXTRA LIFE

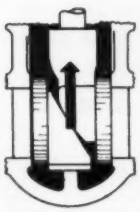
Fully revolving discs, independently hung, change seating position at each closing, assuring uniform wear distribution for prolonged service. Plain "no pocket" discs are interchangeable for *extra* life!



GATE CLOSED

B POSITIVE CLOSING

Faces of the upper wedge are radiused and faces of both wedges are transversely beveled for equalized wedging pressures and tight closing despite valve body distortion.



GATE RISING

C EASIER OPERATION

Wedging pressure on both discs is released before discs start to rise. Complete absence of wedging pressure during travel of discs assures easy operation and greatly prolonged valve life!

VALVES FOR EVERY NEED

Just name it and there's a Darling gate valve of exactly the right size and construction for the job... for all kinds of normal and unusual service, and for pressures up to 1500 pounds.

In addition to the pace setting Darling *fully revolving double disc,* parallel seat gate valve... available in cast steel, iron body, rubber lined iron body, special alloys, and all bronze... there are cast steel solid and *slotted wedge* types.

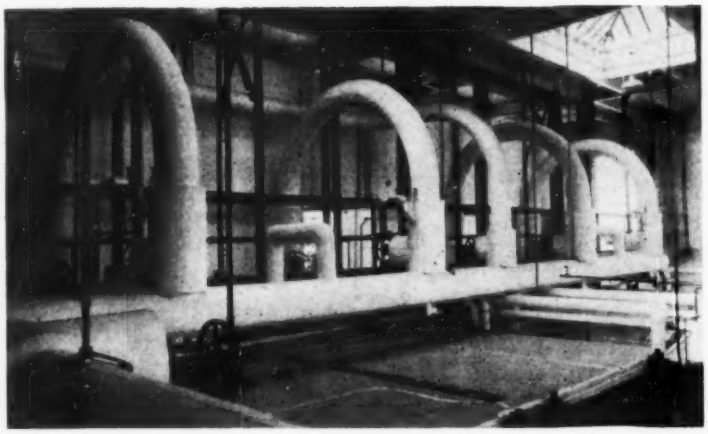
Send for descriptive literature or specify your particular service requirements. *It will pay you to check Darling before you buy any gate valve!*

DARLING VALVE & MANUFACTURING CO.

Williamsport 8, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

NEW HEAT SAVING EFFICIENCY



...with MUNDET "CUSTOM MOLDED" 85% MAGNESIA

Now available in pipe covering and block insulation, Mundet 85% Magnesia permits new heat-saving efficiency. Precision manufacturing on the latest type of automatic equipment insures uniform standards. Extra durability is built into the insulation. It does not "powder", settle or disintegrate. It is unaffected by either steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation. Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7101 Tonnelle Avenue, North Bergen, N. J.

MUNDET

MUNDET

INSULATION FOR HIGH & LOW TEMPERATURE

Mundet district offices are located in these cities:

ATLANTA 339-41 Elizabeth St., N.E.	**CINCINNATI 2** 427 West 4th St.	**INDIANAPOLIS** 15 E. Washington St.	**NEW ORLEANS 16** 315-25 N. Front St.
BOSTON 57 Regent St., N. Cambridge 40	**DALLAS 1** 601 Second Ave.	**JACKSONVILLE 6, FLA.** 800 E. Bay St	**PHILADELPHIA 39** 856 N. 48th St.
CHARLOTTE, N. C. 507 S. Cedar St.	**DETROIT 21** 14401 Prairie St.	**KANSAS CITY 7, MO.** 1428 St. Louis Ave.	**ST. LOUIS 9** 3176 Brannon Ave.
CHICAGO 16 2601 Cottage Grove Ave.	**HOUSTON 1** Commerce and Palmer Sts.	**LOS ANGELES** (Maywood): 6116 Walker Ave.	**SAN FRANCISCO 7** 440 Brannan St.

In Canada: Mundet Cork & Insulation, Ltd. 35 Booth Ave., Toronto

APPOINTMENTS

Corporation Executives

Sylvania Electric Products, Inc announced the elections of H Ward Zimmer as president and Don G Mitchell as chairman of the board of directors. W Benton Harrison was elected to the new post of vice-president in charge of finance. Robert G McIlroy was elected president of **Pittsburgh Standard Conduit Co.**

Former U. S. High Commissioner for Germany John J McCloy was named to the **Westinghouse Electric Corp** board of directors. John K Beidler and Louis P Struble, Jr were made vice-presidents of **Dravo Corp** of Pittsburgh. Clifford A Hill was elected treasurer and Edward T Fitch was named controller of that company. Paul L Hershfield has replaced J L Crawford as president of **Walsh Refractories Corp,** St. Louis, Mo.

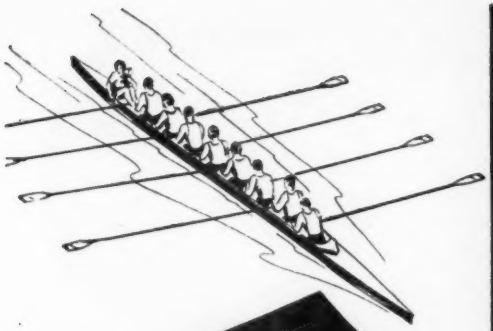
Frank F Kolbe, president of United Electric Coal Co of Chicago, was elected to the board of directors of **Clark Equipment Co,** Battle Creek, Mich. **Hendrick Mfg Co,** Carbondale, Pa., has named Kenneth H Colville Jr as secretary and member of the board of directors. F N Floyd and Arthur G Middleton have been appointed vice-presidents of **United Engineers & Constructors, Inc** of Philadelphia. Robert M Miller and William C Porter Jr were made vice-presidents of **Southern Colorado Power Co.**

Operations Executives

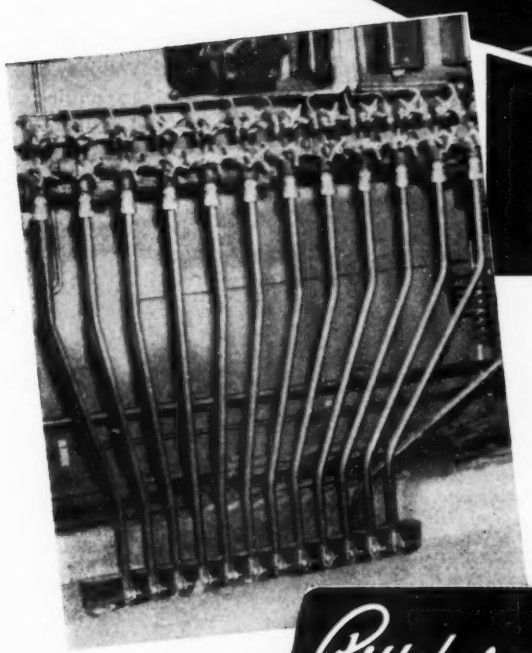
General Electric Co has announced the appointments of: Harry A Winne as special assistant to president Ralph J Cordiner; George L Irvine as vice-president with headquarters in Dallas; Donald L Millham as general manager of the lamp division with headquarters in Cleveland; Thorn L Mayes as general manager of a new small integral motor dept; Clarence E Burke, H Frank Hentschel and Reginald H Jones as department managers of the new switchgear division.

Westinghouse Electric Corp directors have elected five vice-presidents: Bruce D Henderson, purchases and traffic; William C Rowland, manufacturing and repair; Franklin L Snyder, defense products; C Swan Weber, Washington office; Robin S Kersh, New York office. Leslie E Lynde, Washington office, succeeds Snyder as vice-president of the aviation gas turbine division. G I. Wilcox was appointed vice-president of operations and J D Mickle general sales manager of **Westinghouse International Co.** Walter W Wendelken was made director of works engineering for headquarters mfg division, Lawrence Radtke staff assistant in lamps division and I G Fox manager of materials in the transformer division.

U. S. Rubber Co has named Herbert J Reid assistant to the production manager in mechanical goods division and Albert M Stover assistant to the director of research in Naugatuck chemical division. **American Brake Shoe Co** has named John I. Goheen district manager for commercial research on the West Coast; Francis B



(S) TEAM WORK *Makes* STEAM WORK



Pittsburgh Piping GIVES SAME CAREFUL ATTENTION TO CONTROL PIPING THAT IS GIVEN TO MAIN STEAM LINES

The coxswain in a rowing scull is pint-sized — but he is the "control" that extracts smooth, flowing power from the bulging muscles of the oarsmen.

Control piping — a "small" part of a high-pressure, high-temperature system — plays an equally important part in performance. Like all parts of a P.P.&E. job — steam mains, headers and manifolds, bleed lines, etc. — it is engineered, fabricated, tested, and installed with precision.

The reason: 50 years of practice have taught us to know the tremendous importance of minute details. The result: Greater safety, smoother operation, and longer life in every P.P.&E. installation.

Pittsburgh Piping

AND EQUIPMENT COMPANY

10 Forty-Third Street — Pittsburgh, Penna.

Atlanta	Whitehead Building	Houston	Heights State Bank Bldg.
Boston	10 High Street	New Orleans	P. O. Box 74
Chicago	Peoples Gas Building	New York	Woolworth Building
Cleveland	Public Square Building	San Francisco	785 Market Street

Protect all 3...

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PROPERTY
PROCESSES

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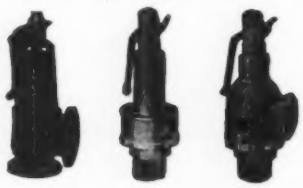
Lonergan

PRESSURE GAUGES

The accuracy and dependability of Lonergan Pressure Gauges for power plant and other industrial services is a real assurance of full protection. They are modern in design and are precision manufactured to meet today's requirements. There are 28 types to choose from and over 100 models that meet a wide range of services. Sizes are from 2½" to 12". For sure satisfaction . . . choose Lonergan. Send for Bulletin 800 G.

Lonergan

SAFETY-RELIEF VALVES



V KDP ODP

For boiler and superheater safety-relief valves in all standard steel, iron and bronze ASME types, specify Lonergan for proven dependability. They are available for pressures from 15 to 1500 psi and for temperatures up to 900° F. Designed for maximum capacity. You can be confident of the finest service from Lonergan valves. For details, write for Bulletin 800 V.

J. E. LONERGAN CO.
SINCE 1872
2nd & Race Sts. Philadelphia 6, Pa.

More APPOINTMENTS

Begins on page 240

Herlihy chief metallurgist of the company; George L Anderson assistant to the general purchasing agent; John R Welsh purchasing agent for ferrous scrap.

S Leonard Schwarz was made superintendent of **De Laval Steam Turbine Co's** North Plant. M M Schratz was elected to a new vice-presidency in **Aluminum Company of America.** David A Griffith was made assistant general manager of **Allis-Chalmers** Pittsburgh Works. **Sylvania Electric Products Inc** elected Walter R Seibert as treasurer and Leon C Guest as controller. **Babcock & Wilcox Co** has named Paul R Loughlin an executive assistant and J E Brinckerhoff general manager of the refractories division.

L E Grubb is now general superintendent of the West Virginia Works of **International Nickel Co, Inc.** John W Anne was elected a vice-president of **Elliot Co,** Jeanette, Pa. and S W Crisman was appointed assistant district manager of that company's Pittsburgh office. **Borg-Warner Corp** of Chicago has given Frank W Rickard the new post of director of manufacturing. **Griscom-Russell Co** has named William H Hunter manager of advertising activities.

Engineers

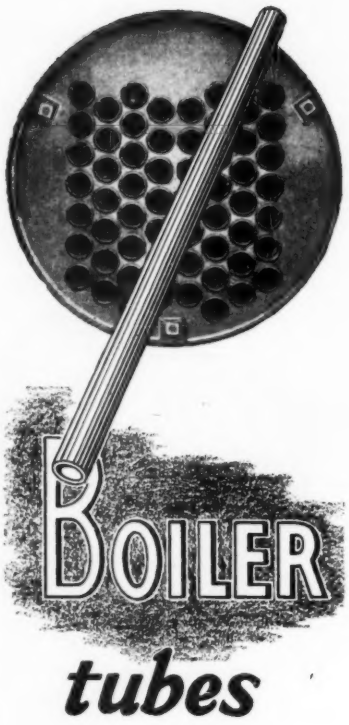
W Allen Brecht is consulting engineer for **Westinghouse's** atomic power division. H E Eigner was named engineer-in-charge of chemical sales in **Allis-Chalmers'** water conditioning section. Erich H Koeller and Radoslav T Mijanovich were appointed research engineers at **Armour Research Foundation** of Illinois Institute of Technology. **Flexible Tubing Corp** names Kenneth C Oestreicher as a development engineer.

James D Laughlin has become assistant chief electrical engineer for the **Los Angeles Department of Water and Power.** Karl M Bausch is new chief electrical engineer at **Bechtel Corp,** San Francisco. Samuel G Harris was named district engineer for the aeronautical and special products divison of **Hagan Corp.** Franz F Kaiser was appointed chief industrial engineer for **Fairbanks, Morse & Co** of Chicago.

Sales Managers, Salesmen

De Laval Separator Co has appointed Walter F Schmid assistant general sales manager. J Allan Greenland was named sales manager of the San Francisco district office of **De Laval Turbine Pacific Co** and Donald T Bixby as sales manager of the Seattle district office. **Fluor Corp, Ltd** of Los Angeles has appointed J W Elizardi Jr vice-president in charge of mid-continent area sales. Harold M Winton has become training director and Chester M Boehn manager of sales policy for the mechanical goods division of **United States Rubber Co.**

Roger O Bay was named sales manager of the tool division of **Bonney Forge & Tool Works,** Allentown, Pa. **Dravo Corp** announces appointment of Philip J Berg to its Detroit office. H E Johnston was named



tubes

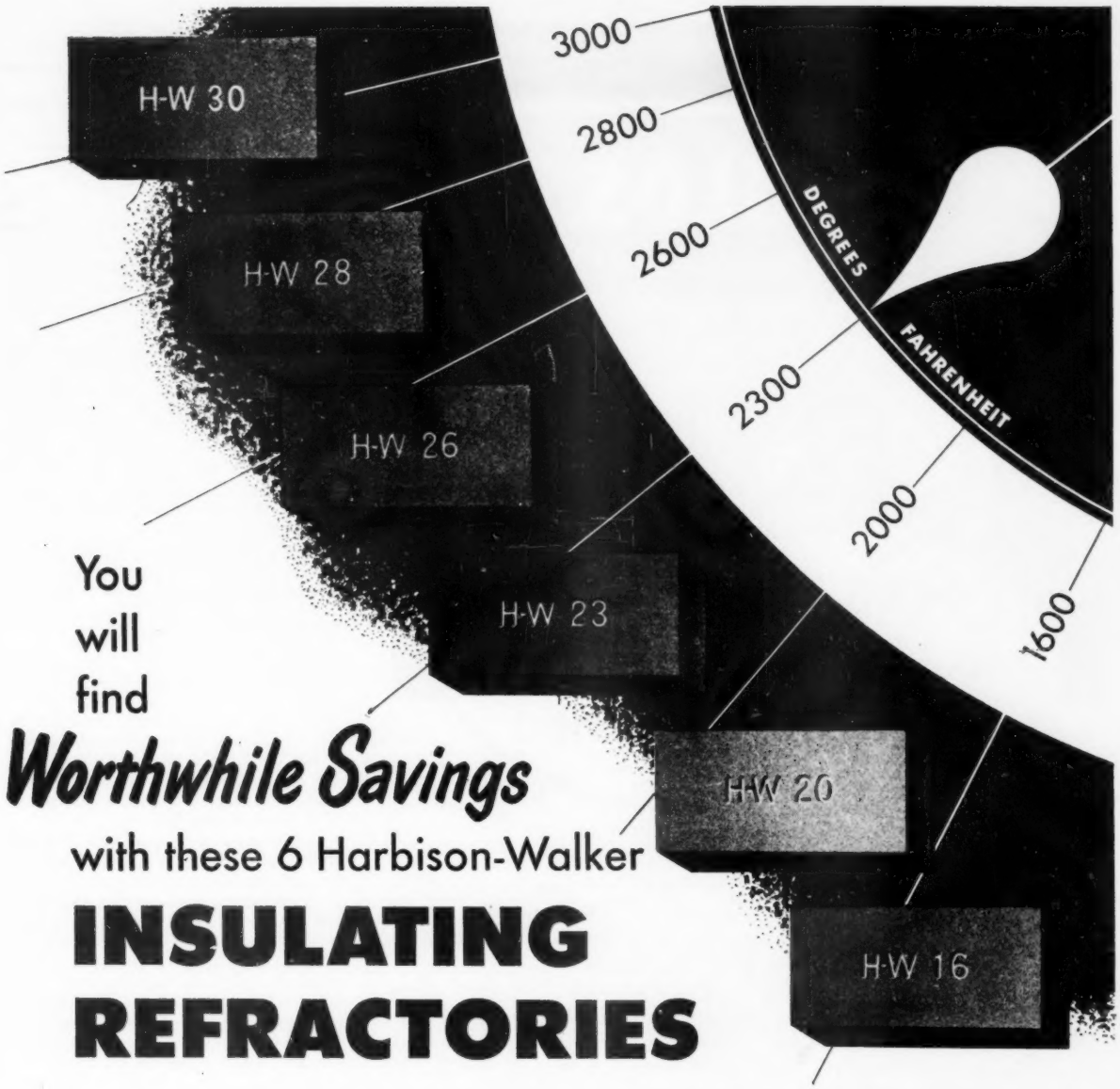
Uniform strength, accurate dimensions and high ductility are three of the many qualities found in Murray boiler tubes. Welded or seamless tubes in sizes ranging from ⅝- to 8-inch OD are available for immediate shipment from warehouse stocks.

If you have a tubing problem, the experience of our specialists and the research facilities of our suppliers are at your service.

Other Murray products include carbon and stainless steel tubing and pipe for pressure and mechanical purposes; welding and screw type pipe and tube fittings. Tube bending, upsetting, swaging.

7251

A B MURRAY CO INC
ESTABLISHED 1845
ELIZABETH, N. J. McKEESPORT, PA.



You will find

Worthwhile Savings

with these 6 Harbison-Walker

INSULATING REFRACTORIES

Harbison-Walker Engineering Service will help you with the selection of the insulating refractories best suited for your requirements.

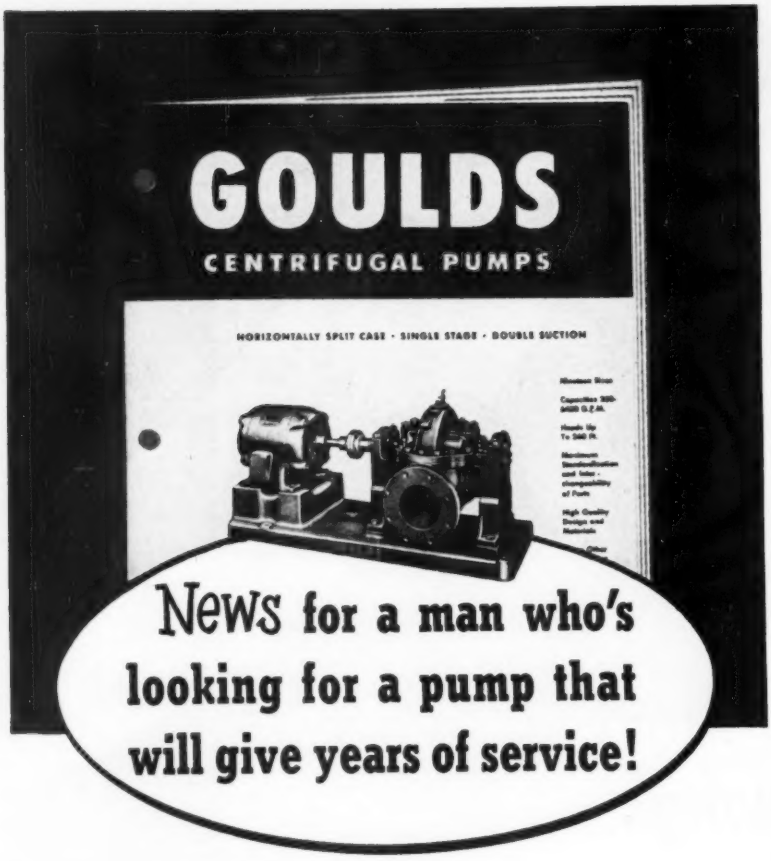
The balanced properties of Harbison-Walker Insulating Brick mean superior performance and dependable service. Light weight, essential to high insulating value and low heat storage, has been attained to the greatest degree consistent with the good mechanical strength necessary for handling and for many furnace structures.

Available in six classes, suitable for service in the temperature ranges indicated above, Harbison-Walker Insulating Brick reduce heat losses, save space, absorb noise, conserve fuel.

H-W 85 and H-W 56 CASTABLES are widely used to great advantage in monolithic structures for refractory insulation.

We will gladly send you bulletins containing data and descriptive information about Harbison-Walker Insulating Brick and Insulating Castables.

HARBISON-WALKER REFRACTORIES COMPANY
AND SUBSIDIARIES
World's Largest Producer of Refractories
GENERAL OFFICES PITTSBURGH 22, PENNSYLVANIA



News for a man who's looking for a pump that will give years of service!

For fifty years we've been learning from our industrial customers what they want in centrifugal pumps.

We've come as close as modern design and materials allow to putting what you've taught us into our new Fig. 3405 pump.

The quality of materials and extras of design that you have been able to get only by paying *extra* are *standard* on this pump: stuffing box bushings, bearing housings sealed against moisture and dirt, stainless steel impeller keys, Teflon water seal rings—just to mention a few.

The Fig. 3405 carries interchangeability of parts far beyond anything we've been able to do before. Only three shaft and impeller assemblies provide for 19 pump sizes, or 38 pump combinations, counting right- and left-hand rotation.

This can mean real spare parts inventory savings for any plant that uses many pumps. It also means easy-to-make field changes to meet new requirements.

You'll find a lot to interest you that we can't tell you about here in the 12-page illustrated bulletin on our new Fig. 3405 pump. We think you'll agree that here's a pump with everything for long, satisfactory service.

Just fill in the coupon to get a copy of the bulletin, pin it to your letterhead and mail it to us at your convenience.

Goulds PUMPS INC. Seneca Falls New York

GOULDS PUMPS, INC.
Dept. PO, Seneca Falls, N. Y.
Please send me Bulletin No. 721.6 describing the new Fig. 3405 centrifugal pump.

Name_____

Company_____

Address_____

City_____ State_____

More APPOINTMENTS

Begins on page 240

manager of the New York office of **Dearborn Chemical Co** of Chicago.

Graybar Electric Co has appointed the following district sales managers: J P McCarthy, New York; F C Sweeney, Newark; H J Fitzpatrick, Albany; E E Leavy, Salt Lake City; B F Keyfauver, Phoenix. **Sterling Electric Motors, Inc** has appointed Kenneth J Plants district manager for the New York office; John R Howell and Robert T Dudley were named regional sales managers.

Harry G Lake, recently returned from army service, has been re-appointed to the plastics department of **General Electric Co;** Alfred E Carpluk has joined the sales staff of the company's Trumbull electric department. Martin E Conroy has joined the technical sales staff of the chemical mfg division, **M W Kellogg Co.** Rodger C Swift has been assigned to **Norton Co's** central Illinois territory as an abrasive engineer. **Erie City Iron Works** has appointed Fred D Mosher district sales agent for the Buffalo-Rochester-Erie area.

Sales and Service Officers

General Electric Co's apparatus sales division has established two new districts: an Empire district managed by William J Woods with headquarters at Syracuse and a Pacific Southwest district with headquarters in Los Angeles. **Allis-Chalmers'** general machinery division has opened a Des Moines branch office under the management of Edward A Rensch.

The third engineering office of **Babcock & Wilcox Co** to be located in Florida in the past two years will be opened in Miami under the management of J E V Dingemans and W H Barrere. Robert T Dean, manager of the Duluth Sales Office of **Trane Co,** has announced the Duluth office now is located at 414 Lyceum Bldg, Duluth 2, Minn. George W Robbins was appointed manager at Trane's new sub-office at Fargo, N. D. The new location of the company's Columbia, S. C. office is 2740 Devine St.

Reliance Electric & Engineering Co has opened a Baltimore branch office staffed by A C Schettler and W C Mitchell, sales engineers. The Buffalo branch office of **Thor Power Tool Co** has moved into a new building at 735 Military Rd, under the direction of C T Connolly.

The opening of a new Kansas City district office was announced by **Clark Bros Co.** Located at 6 E 11th St, Kansas City 6, Mo., this office will be under the direction of A G Van Campen, former district manager of Clark's Tulsa office. **Orr & Sembower, Inc** has announced the opening of a New York office at 51 E 42nd St under the supervision of Jared Darlington III.

Distributors, Representatives

Westinghouse Electric Corp announced it is leaving the stoker business and **Detroit Stoker Co** of Monroe, Mich. will take over renewal parts and service. Westinghouse's plant will continue to operate until current contracts are filled.

(*Continued on page 246*)

For power from steam DEALKALIZE WITH

AMBERLITE IRA-410

Without Acids or Degasifiers

Here are the facts about dealkalization with AMBERLITE IRA-410:

1. Alkalinity of water supplies for boiler feed and evaporator coolers may be conveniently controlled at low cost.
2. No acid-resistant or degasification equipment is necessary.
3. Because line pressure is not broken, pumping costs are eliminated.
4. Only low cost salt is required for regeneration—3 to 4 lb. per cubic foot of resin.
5. Combinations of the anion exchanger, AMBERLITE IRA-410, and the cation exchanger, AMBERLITE IR-120, permit simultaneous softening and dealkalization in a single column.

AMBERLITE is a trademark, Reg. U. S. Pat. Off. and in principal foreign countries.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

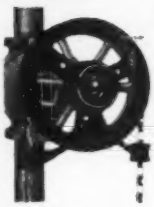
For more information about dealkalization with AMBERLITE IRA-410, write Dept. P-1 for complete literature. For bi-monthly reports on new developments in ion exchange, ask to receive AMBER-HI-LITES.

Play it SAFE with . . .

Babbitt
Adjustable
SPROCKET RIM
with Chain Guide

Avoid accidents and costly claims against your company! Operate overhead valves direct from the floor — without ladder climbing, balancing on boilers, standing on workbenches and machines or other risky perches.

Check these outstanding advantages of Babbitt Adjustable Sprocket Rim with Chain Guide:



- Cuts fuel & steam waste
- Fits all valve wheels
- Prevents accidents

Range of 10 adjustable sizes fits all valve wheels from 2 to 30 inches diameter, with rising or non-rising stems. Only four simple parts, quickly-assembled, quickly installed.

Call your Industrial Distributor. He carries complete stocks. Or write for descriptive folder and prices.

Babbitt STEAM SPECIALTY CO.

2 BABBITT SQUARE, NEW BEDFORD, MASS.

2 of the five departments in

POWER's MODERN PLANT HANDBOOK

(Coming in September)

hold valuable reference data available nowhere else:

The Directory of Manufacturers and The Modern Plant Survey

NICHOLSON TRAPS

SAVE CAR OF COAL WEEKLY

for This Large Steam User

Following replacement of all steam traps of various makes, with Nicholson units, an Eastern college reports:—"An average coal saving of 1 carload per week besides much better heat distribution". Credit is given the higher and more even temperatures which Nicholson traps effect. See why large industrial and institutional steam users are increasingly standardizing on Nicholsons. 5 types; for heat, power, process; sizes ¼" to 2"; pressures to 250 lbs.

BULLETIN 152
125 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

More APPOINTMENTS

Begins on page 240

King-Knight Co of San Francisco was appointed distributor for **Nordberg** 4FS diesel engines. **Warren Steam Pump Co, Inc** announced the appointment of Meters and Controls, Inc as their sales representatives in the Illinois-Indiana-Iowa district. **Orr & Sembower, Inc** has appointed C A Breed, Inc, representatives handling packaged automatic boilers in the Boston area.

James H W Conklin, general sales manager of the Yale materials handling division, names Materials Handling Products Corp of Syracuse as distributors for **Yale & Towne Mfg Co** of Philadelphia. **Farr Co** of Los Angeles has four new representatives: St Louis Air Filter Sales & Serv Co; Air Filter Sales and Service—Denver; Air Filter Sales & Service—Minneapolis; Dust Control, Inc, Hawthorne and San Diego.

New Names, Addresses, Purchases, Etc

A new factory will be opened at Warren, Ill. to expand production of the micro division of **Minneapolis-Honeywell Regulator Co.** Earth-moving, tractor and related business of R G LeTourneau, Inc were purchased by **Westinghouse Air Brake Co** for $19½ million. The new business will be operated as the LeTourneau-Westinghouse Co, a subsidiary of Westinghouse Air Brake. **Combustion Engineering-Superheater, Inc** changed its name to Combustion Engineering, Inc.

Laclede-Christy Co has purchased the plant properties of the Whitehall Sewer Pipe and Stoneware Co at Whitehall, Ill. **Clark Equipment Co** acquired all the capital stock of the Ross Carrier Co of Benton Harbor, Mich. Merger of **Federal Electric Products Co** and **Pacific Electric Mfg Corp** was announced by both concerns.

Societies, Schools, Institutes, Etc

Roger L Wensley, board chairman of G M Basford Co, accepted the chairmanship of the corporate fund committee for **Columbia University's** new Engineering Center. Allen Abrams, vice-president of the Marathon Corp of Wisconsin, was elected president of the **Industrial Research Institute.** John H Chiles, Jr, manager of engineering for Westinghouse's transformer division at Sharon, Pa, was named chairman of the **American Standards Association's** Sectional Committee C-57 on transformers, regulators, and reactors.

Obituaries

Emmett A Williams, 62, vice-president of the national bearing division of American Brake Shoe Co, April 14, St. Louis, Mo.

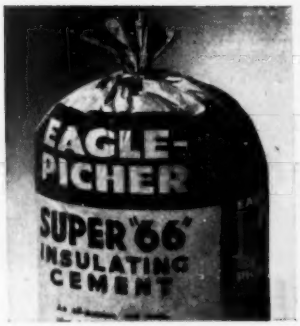
Hugh Jay Beach, 60, president of Flexible Steel Lacing Co, March 31, Glen Ellyn, Ill.

Benjamin H Nichols, 55, associate professor of electrical engineering at Oregon State College, May 5, Eugene, Ore.

Lloyd F Jaynes, 50, superintendent of the Canon City division of Southern Colorado Power Co, March 31.

EAGLE-PICHER

Super "66" Insulating Cement



Conforms to Commercial Standard CS-117

Because Eagle-Picher Super "66" Insulating Cement *really sticks*, it has money-saving advantages that are apparent the minute your crew begins to apply it.

Because *it sticks*—less time is wasted in application—it stays where you put it whether the equipment is heated or temporarily out of service. It "holds together" — usually no reinforcing needed on applications up to 1½ inches thick.

Because *it sticks*—Super "66" can be used effectively, economically on all types of surfaces—flat, curved, overhead—anywhere you need insulation. It's truly an all-purpose cement.

And—Super "66" is rust-inhibitive—cannot cause corrosion–actually helps prevent corrosion of costly equipment.

If you've never tried Eagle-Picher Super "66," it will pay you to learn more about it today!

"Springy Ball" structure—*the secret of the high thermal efficiency of Super "66." These small, resilient pellets of mineral wool, each one honeycombed with thousands of minute air cells, effectively resist the flow of heat even when used on equipment heated to 1800 F.*

Since 1843

EAGLE EP PICHER

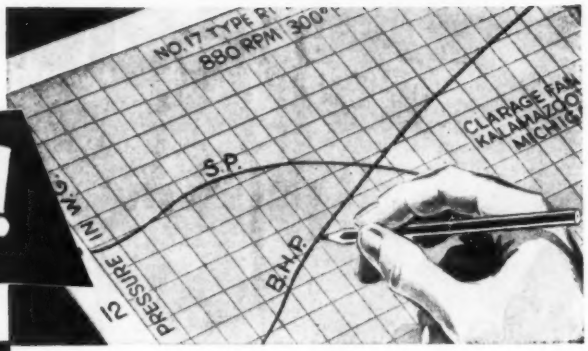
THE EAGLE-PICHER COMPANY

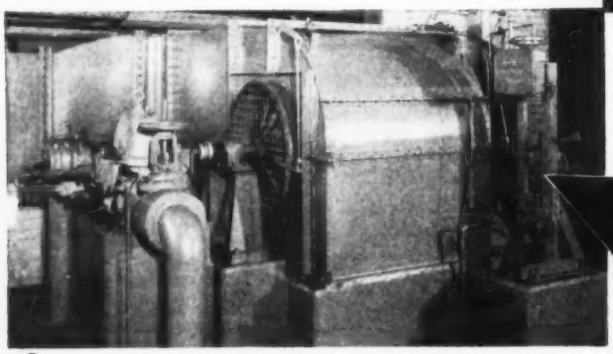
General Offices: Cincinnati (1), Ohio

For greater efficiency, protection and economy, you should investigate these Eagle-Picher products: Insulating Felts • Insulating Block • Blankets • Loose Wool • Mineral Wool Pipe Covering • Stalastic Stamastic • Insulseal • Finishing Cements • Insulating Cements • Swetchek • Insul-Stic • Fireproofing Cement

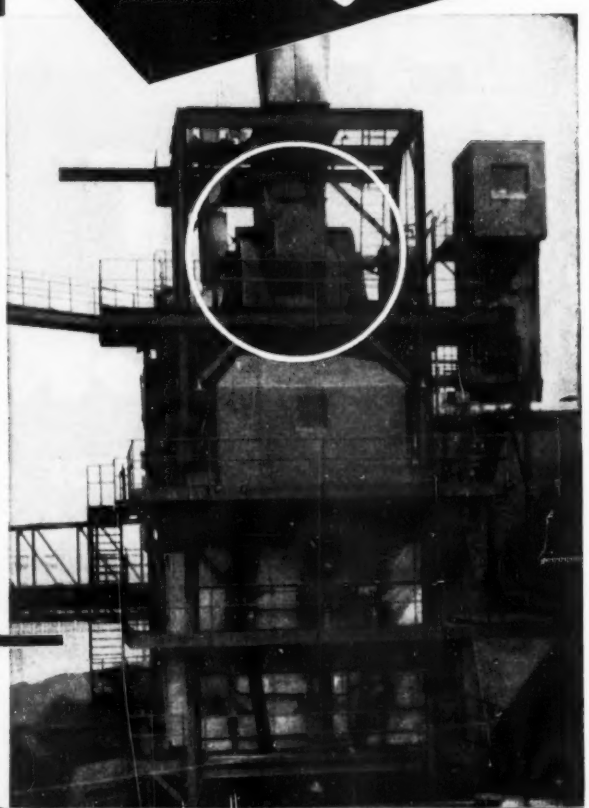
Member of Industrial Mineral Fibre Institute

figured right!





built right!



The most exacting service a fan gets into is mechanical draft.

If the fan is too small, you may lack capacity for peak loads . . . too large, and you may have wasted money and space . . . inferior construction, and, well, that's real trouble.

We are specialists with long experience in meeting mechanical draft problems.

You can have faith in a Clarage recommendation — faith that your job is figured RIGHT for the required performance — faith that the equipment is built RIGHT to operate year after year with minimum attention and care.

Boiler and stoker manufacturers have a high regard for Clarage engineering and construction. Ask anyone of them, or write us for detailed information.

CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN

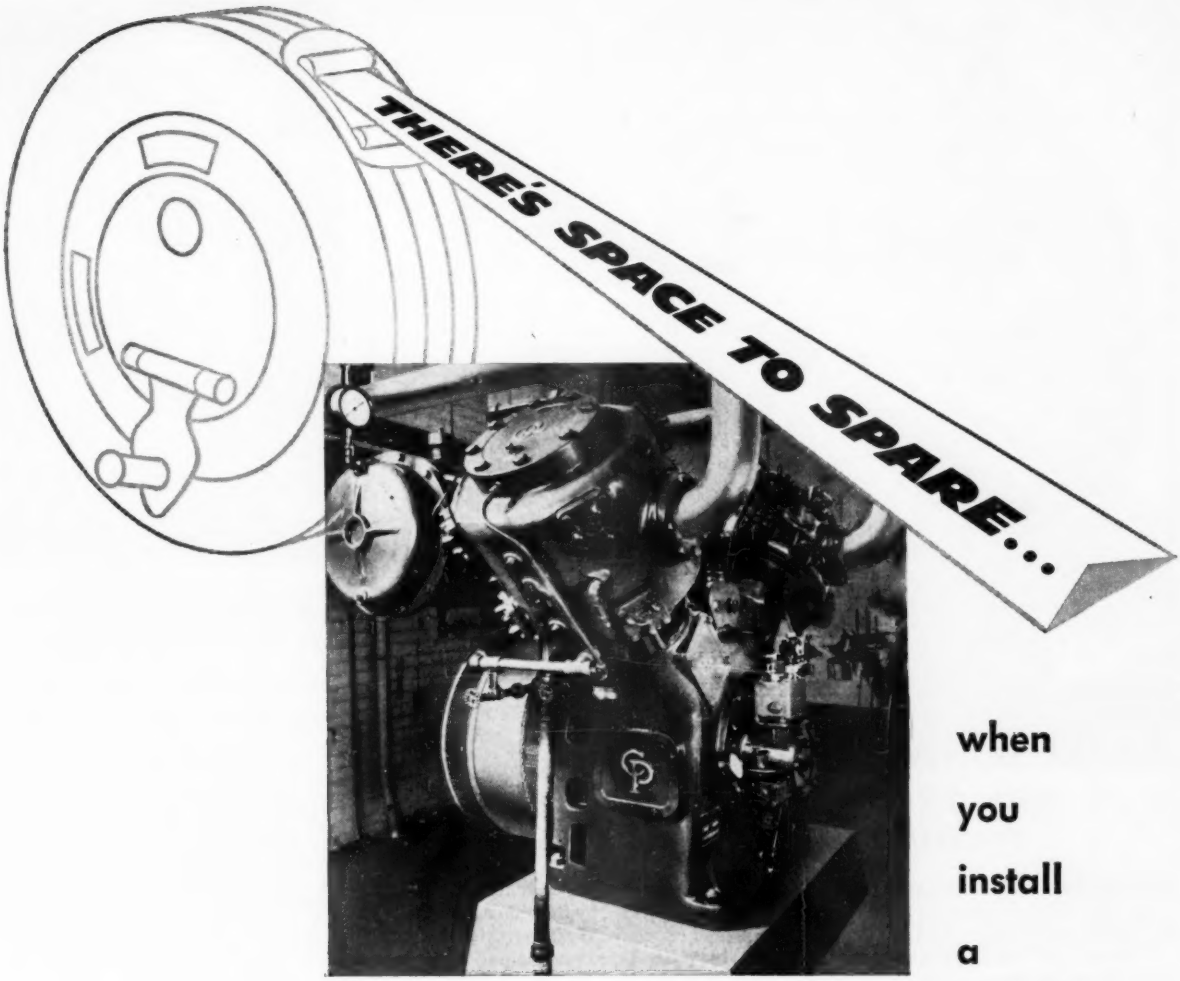
Over 3000 Public Utilities and Industrial Power Plants Use Clarage Mechanical Draft Fans

You can Rely on...

CLARAGE

Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal



when you install a

TYPE Y....

compressor

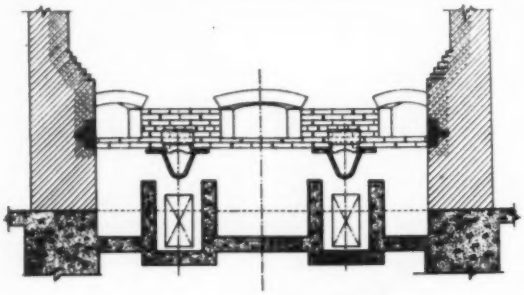
Where space is limited, industry relies more and more on Chicago Pneumatic's compact, heavy-duty Type Y Compressor. It takes up minimum floor area, yet is ideal for long, continuous heavy duty. Shipped as a complete "package" ready for easy installation, it requires the simplest of foundations—needs no alignment.

The highly efficient Type Y Compressor has roller main bearings, precision connecting rod bearings, multi-step capacity regulation, and an easy-to-clean shell-and-tube intercooler.

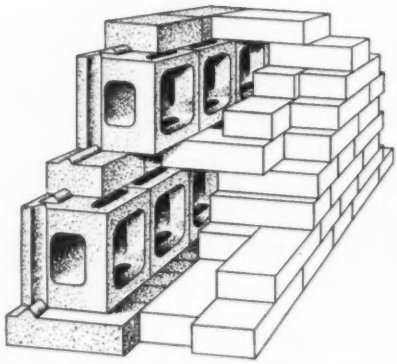
Available in sizes from 75 hp to 250 hp, 410 cfm. to 1663 cfm., and with flange mounted, belted and coupled motors. Write for Bulletin 766. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



CRYSTOLON
Solid Brick
Construction



CRYSTOLON
Air-Cooled
Block
Construction

Avoid Boiler Furnace Shutdowns...

with CRYSTOLON refractories protecting the "Trouble Zone"*

With the right kind of wall protection in your boiler furnaces, you cut shutdowns and maintenance costs to a minimum.

Norton CRYSTOLON (silicon carbide) refractory shapes — solid bricks or hollow air-cooled blocks — form a real "safety belt" for this trouble zone. That's because they offer outstanding protection against these three frequent causes of furnace failure:

High Heat. CRYSTOLON shapes are so highly refractory that they withstand temperatures up to 3100 F.

Slag Penetration. CRYSTOLON bricks and blocks, made with a maximum percentage of silicon carbide, are so structurally dense that even when clinkers adhere — which happens very rarely — they can be easily removed.

Abrasion. CRYSTOLON silicon carbide, being a tough abrasive itself, is not noticeably affected by the abrasion of the moving fire beds of stoker-fired furnaces.

Why waste time, trouble and money on refractories that spall, erode or crack? Investigate how quickly CRYSTOLON shapes pay for themselves with trouble-free service.

Norton RA1019 ALUNDUM Cement adds extra life to furnace walls*

One way to assure long lasting boiler furnace walls is to lay up your brick with Norton RA1019 ALUNDUM cement. Containing 80% fused alumina, this fine-ground, chemically stable cement matures at 1850 F and resists temperatures up to 3100 F — qualities that mean strong, thin, firmly sealed joints in both silicon carbide and fused alumina brick.

*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries

NORTON

Special REFRACTORIES

Making better products to make other products better

NORTON COMPANY, WORCESTER 6, MASSACHUSETTS

CRYSTOLON Armor Blocks in your water tube boilers give low-cost protection against high heat

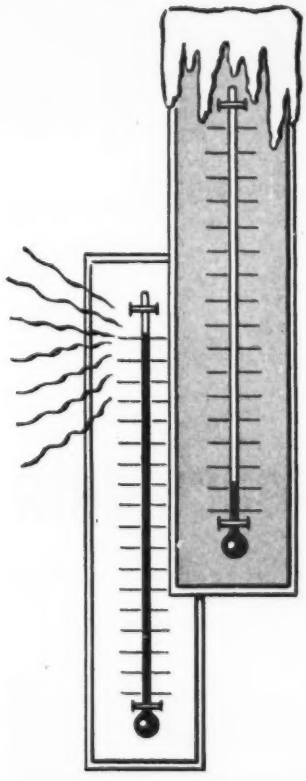
High refractoriness that stands up under today's increasing boiler furnace temperatures is just one big advantage of Norton CRYSTOLON Armor Blocks. In addition, they have great resistance to slag penetration and abrasion — plus the high thermal conductivity that promotes even heat distribution and affords maximum protection to tubes from localized heat generation and flame impingement.

Installation is easy and inexpensive. Adjoining surfaces of blocks are tapered, for secure locking and intimate contact with tubes. Bent or straight tube sections can be replaced from the fire side and are laid dry, further reducing installation costs. Tubes require no cleaning or grinding.

For prices and full information, send data on tube diameters, tube spacing, radius of curvature of bent sections and areas to be curved.

Know the Facts

These two Norton bulletins contain plenty of valuable information on the properties and selection of both refractory brick and cement. Ask your Norton Representative for Bulletins 862 and 863, or write direct to NORTON COMPANY, 446 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.



Make heavy oil flow freely in winter as in summer

G-Fin Heaters assure ready withdrawal of fuel oil, lube oil, crude oil, tar or asphalt from storage tanks no matter how cold the weather.

EFFICIENT . . . *use less steam* because only the oil at point of withdrawal from the tank is heated . . . *greatest heating effectiveness* because the G-Fin heating elements have over six times more heating surface than bare tubes of the same size . . . *least pressure drop* because of the straight-through flow of oil.

LOW MAINTENANCE . . . *fewest tube joints* because of the small number of G-Fin elements . . . *easily examined* because the cover can be removed for inspection of tube joints while the tank is full of oil . . . *quickly cleaned* because of few tubes and complete accessibility of entire length and diameter of tubes.

DURABLE . . . *leakproof joints* because of metal-to-metal contact between conical tube ends and tube sheet made tight by accurate machining and held tight by lock-nuts . . . *no temperature strains* because U-bend tubes are free to expand and contract.

These units are built in a large range of sizes and in two designs for installation partly within or entirely outside of tank.

Write for descriptive bulletin.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

G-R
HEAT TRANSFER APPARATUS

G-Fin Storage Tank Oil Heater

GR-318

in September

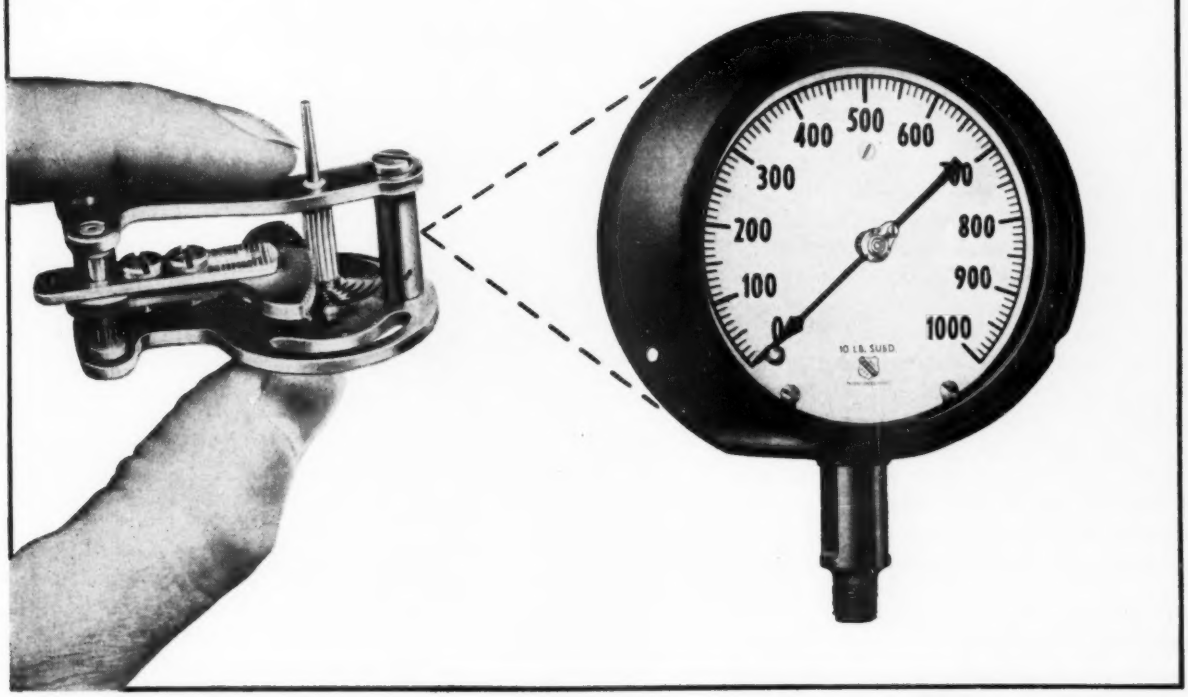
presents an extra issue, geared to a new, important industry trend, featuring reference data of long-established usefulness...

IN IT YOU WILL FIND: POWER's **Modern Plant Survey,** an annual compilation of technical data covering more than 500 new steam and hydro plants . . . **The Renovation Roundup** presents 200 (or more) carefully screened ideas for efficiency and cost-cutting in plant modernization programs . . . **The Directory of Manufacturers** lists names and addresses of over 1,000 manufacturers of power-field equipment, over 600 product categories . . . **Cross File of Obsolescence** tells the names of former manufacturers coupled with the names and addresses of successor companies . . . **The Show Case** is a carefully assembled portfolio of new products, with new product literature described in the same pages and double order cards for readers' convenience.

. . . ALL IN THE MODERN PLANT HANDBOOK LOOK FOR IT *in September*

you'll want to save and use your copy

LASTS FAR LONGER IN ANY SERVICE...



ASHCROFT DURAGAUGE WITH *Nylon Movement**

Nylon is light, strong, highly resistant to frictional wear. It absorbs vibration and doesn't corrode. It is dimensionally stable under high temperatures. That's why the bearings and pinion gear in the Ashcroft Duragauge movement are made of nylon. Mated with stainless steel parts and incorporating the rotary gear principle used in the finest watches, the result is a pressure gauge that gives longer service, sustained high accuracy and greatly improved sensitivity of indication.

The enduring dependability of precision-built Ashcroft Duragauges with Nylon Movement has been proved in the most "killing" services. Petroleum refineries, chemical plants and power stations know from experience that they *outlast all others.* So — if you want accurate pressure indication or recording to insure maximum safety, product quality, or cost control — install Ashcroft Duragauges. Your nearby Ashcroft Distributor will gladly help you select the proper Duragauges for your applications.

*Patented

Centralize Your Purchasing. Take advantage of the simplified buying procedures, low inventory investment and fast delivery service made possible by the facilities of your local Industrial Supply Distributor. Remember, he stocks hundreds of top-quality items and is your most reliable source for data on all that's new in time and money-saving products and methods.

1850 ASHCROFT U.S.A.

MAXWELL MANNING & MOORE INC. TRADE MARK

ASHCROFT GAUGES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

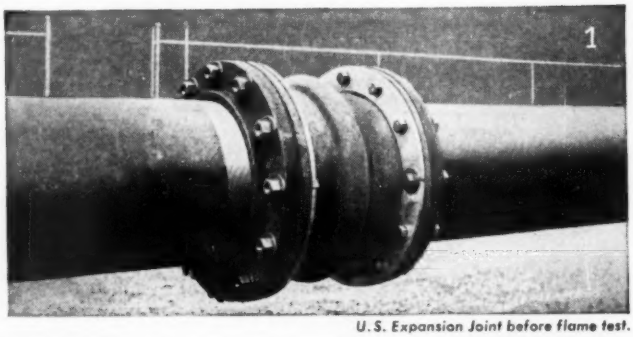
MAKERS OF 'ASHCROFT' GAUGES, 'HANCOCK' VALVES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, AIRCRAFT PRODUCTS. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

What's U.S. Rubber doing with expansion joints?

Making them flame-resistant, among other things. The U.S. Asbeston Expansion Joint originated by "U.S." is invaluable where fire is a hazard, and failure would shut down plant operations. Recommended for hot, dry gases (not steam) up to 300°F intermittently. The U.S. Asbeston, as well as the regular line of U.S. Rubber Expansion Joints, is used in pipe lines and mechanical equipment to absorb excess stresses due to expansion and contraction, to insulate against vibration, and to prevent the transmission of undesirable sound. These joints are also built to take care of misalignment, and are furnished either for pressure, or vacuum or both conditions: also specially made for fire safety on shipboard.

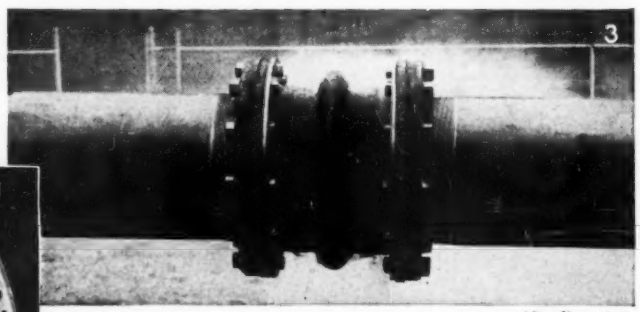
U.S. Rubber Expansion Joints eliminate many costly repairs, increase operating efficiency and extend the life of equipment. Because there are no moving parts to wear or bind, they give many years of service. Note in photos at right how an Asbeston test joint withstood a direct flame from fire built under it.

"U.S." has over 28 years' experience manufacturing expansion joints. Write to address below.



U.S. Expansion Joint before flame test.

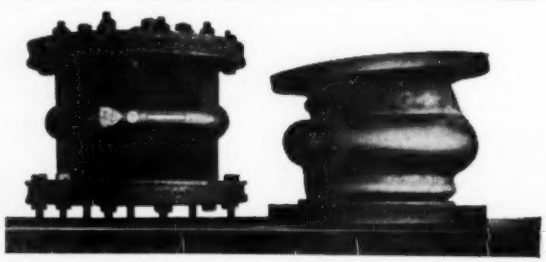
During flame test.



After flame test.

U.S. Asbeston® Expansion Joints are flame-resistant. They have been approved by government and industry.

One of two U.S. Rubber Expansion Joints used in condenser turbines of a power development plant in Oklahoma. The triple arch joint shown has inner diameter of 72" and the joints will compress 2½" to 3" and expand 1¼" to 1½".



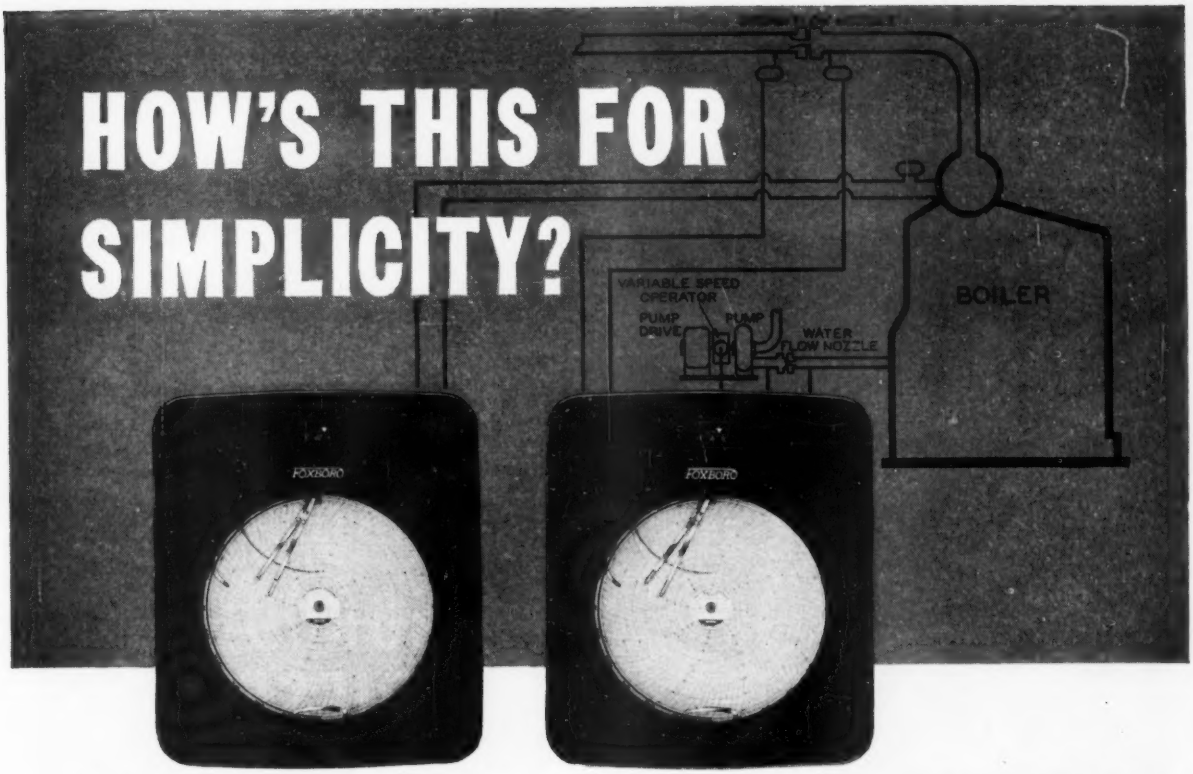
In a test for shock, a metal joint and a U.S. Expansion Joint were filled with water and 463 lb. weight was dropped on each from a height of 10 feet. The metal joint (at right) collapsed at the first shock, while the U.S. Joint remained unaffected even after the test was stopped at 15 feet.

PRODUCTS OF U.S.RUBBER SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

HOW'S THIS FOR SIMPLICITY?



M-40 Recording Liquid Level Controller

M-40 Recording Steam Flow/Water Flow Pneumaticset Ratio Controller

3-Element Control for Boiler Feed Water with ONLY 2 INSTRUMENTS... NO AVERAGING RELAYS

Here's an opportunity to simplify boiler feed water control . . . and make it more dependable too. With this Foxboro system on a boiler of high steaming rate and low drum capacity, you get all the advantages of 3-element control, *plus* ratio-setting automatically adjusted by boiler water level. Ratio setting is undisturbed by the temporary effect of "swell" or "shrink" caused by sudden load changes.

This new standard of simplicity and dependability in boiler feed water control is made possible by two Foxboro Instruments, the M-40 Recording Steam Flow/Water Flow Pneumaticset Ratio Controller and the M-40 Recording Level Controller. The flexibility of Pneumaticset is outstanding . . . making the following combinations available almost instantly: (a) full automatic—steam flow/-water flow ratio controlled, with ratio set by level; (b) semi-automatic—steam flow/water flow ratio controlled, with ratio set by hand; (c) remote manual—feed water valve manually positioned from instrument.

Engineering data are available to help you check and compare this system. Write **The Foxboro Company, 687 Neponset Avenue, Foxboro, Mass., U. S. A.**

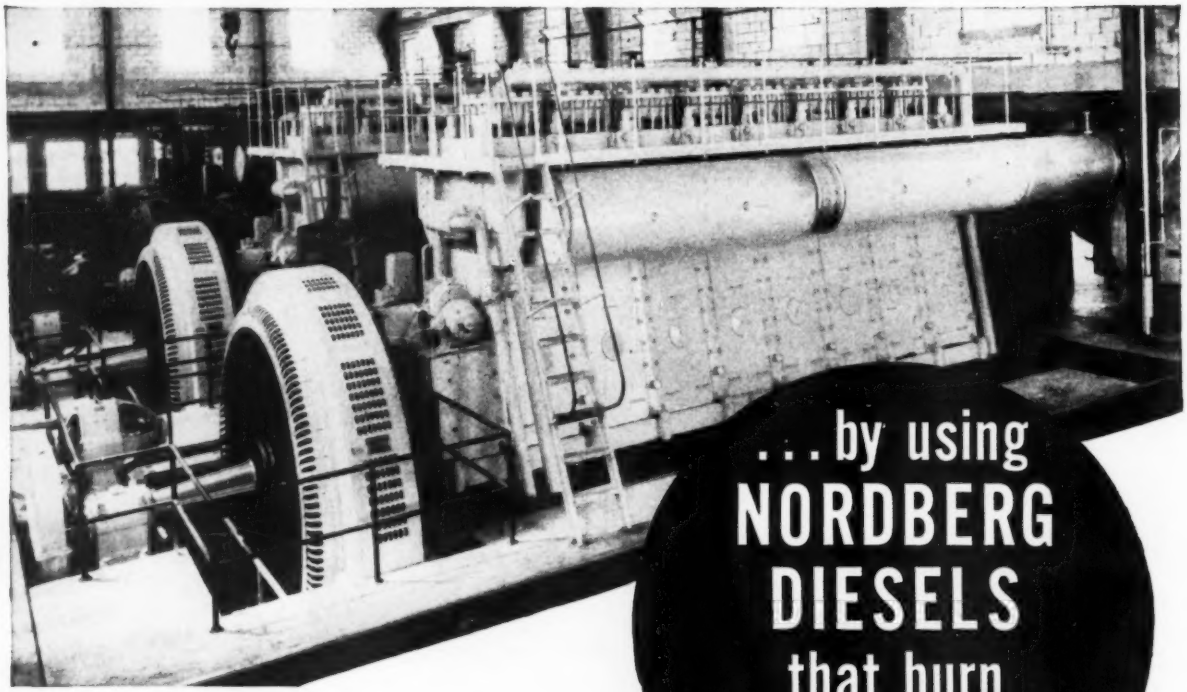
THESE M-40 FEATURES INSURE UNUSUAL RELIABILITY

1. Unmatched ease and stability of adjustment **2.** Emergency-proofed—instrument can be dismounted without disturbing manual control panel **3.** Self-aligning ball linkage—pinch clip for easy removal **4.** Main and sub-assemblies interchangeable with those of other M-40 Controllers **5.** Precision-built, inside and out **6.** Proportional band setting, 0 to 200, either direct or reverse action made by turn of dial **7.** Wide range variable reset resistance, 0.1 to 50 minutes, without use of needle valves or lengths of capillary tubing

FOXBORO
REG. U. S. PAT. OFF.

RECORDING · CONTROLLING · INDICATING
INSTRUMENTS

CUT POWER COSTS...



...by using NORDBERG DIESELS that burn Heavy Fuel Oils!

ONE positive way to cut power costs is to use engines that burn more economical Bunker C or residual fuel oils. Nordberg's more than 30 years' experience in the use of heavy fuels is backed by hundreds of thousands of successful engine hours. Nordberg heavy duty two-cycle Diesel engines are built to give maximum operating efficiency at all loads on these cheaper heavier fuel oils.

The installation at Lake Worth, Florida (shown above) typifies the way in which Nordberg Diesels reduce power costs. In this municipal power plant, two Nordberg 3540 hp two-cycle Diesels, operating on heavy fuel oil, have produced an annual saving in fuel cost of over $65,000 . . . another efficient, economical power job well done with Nordberg engines.

In addition to their ability to burn heavy fuel oils, Nordberg Diesels offer many other advantages for municipal and industrial power service, including BUILT-IN DEPENDABILITY . . . PROVED PERFORMANCE . . . ECONOMY OF OPERATION AT ALL LOADS . . . CONTROLLED POWER . . . LOW MAINTENANCE . . . COMPLETE ACCESSIBILITY. Nordberg builds the largest line of heavy duty Diesel engines in America, from 10 to over 10,000 horsepower.

Write for further details, outlining your power requirements.

NORDBERG MFG. CO., Milwaukee, Wisconsin

NORDBERG

DIESEL • DUAFUEL® AND SPARK-FIRED GAS ENGINES

P753

Guaranteed TO SHUT TIGHT*

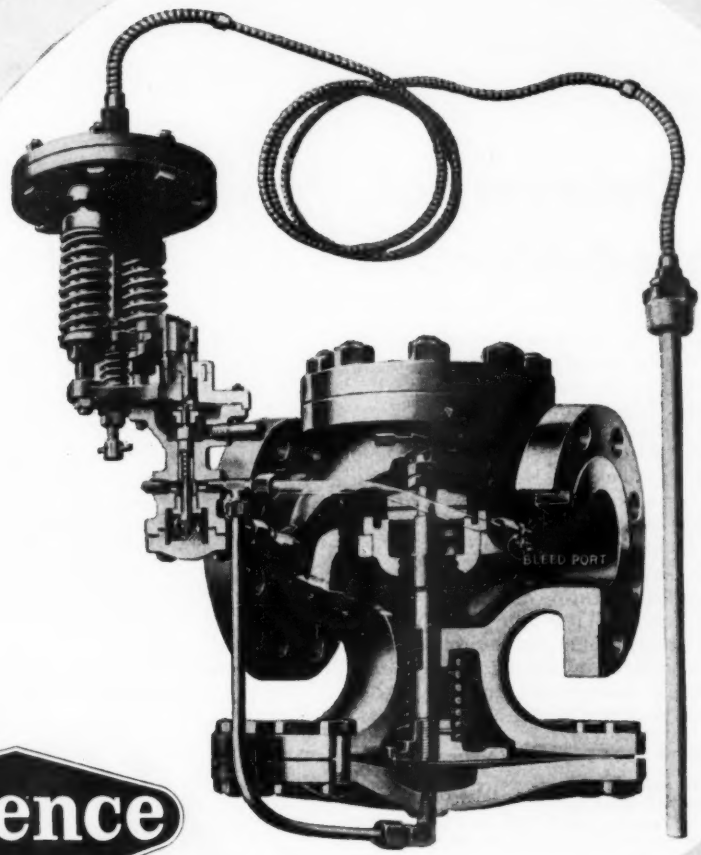
*When equipped with a SECO Metal Seat and Disc on steam service and protected by an approved Strainer, a Spence Regulator is guaranteed to shut tight when the demand for steam ceases.

Expensive steam leaks due to a lack of absolutely tight shutoff are eliminated in Spence Temperature Regulators. Here is why we can make such a guarantee:

First, our temperature regulators are of the single seat design. Seats and discs are made of durable SECO Metal. More than 20 years experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year without requiring expensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.



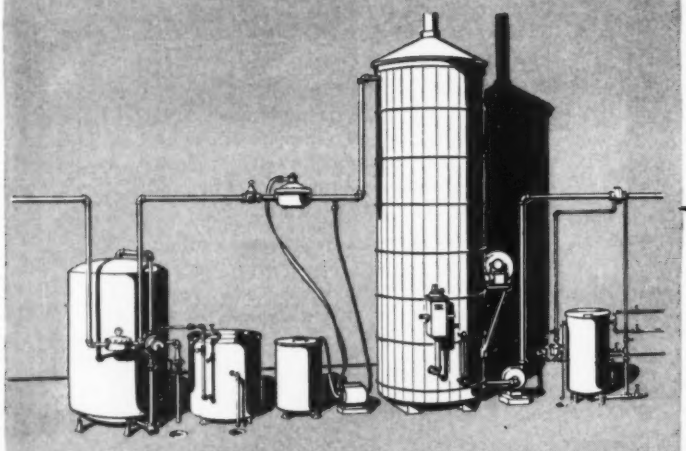
SPENCE
TYPE ET150
Temperature
Regulator

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

88 189

Zeolite-Alkalinity Neutralization Water Conditioning System



Selected by Leonard

Leonard Construction Company
—consultants and builders

...for these six projects

- Swift & Company, Agricola, Fla.
- Swift & Company, Calumet City, Ill.
- Armour & Company, Bartow, Fla.
- Smith & Douglas, Streator, Ill.
- Davison Chemical Corp., Bartow, Fla.
- International Minerals & Chemical Corp., Mason City, Iowa

Delivers Soft Water of low Controlled-Alkalinity and free from CO_2

Leonard Construction Company, well known consultants and builders, is one more in a long list of leading firms that are selecting Elgin Water Conditioning for the exacting requirements of projects such as those listed above. The system graphically illustrated is but one of our many water conditioning systems. It consists of a sodium zeolite water softener followed by acid feed and degasification. Here is the economical answer where soft water of low controlled-alkalinity and free from CO_2 is required. Costly destruction of return lines and equipment resulting from corrosion is prevented.

When heat recovery or blowdown savings will not justify the expense of split-stream dealkalization or deionizing equipment, this system has proven a reliable and highly effective means of overcoming the problem of corrosion in return condensate lines. Being low in investment cost, simple to operate, and requiring but little space, this system is widely used. It will pay you to investigate its many advantages.

A Complete Line To Meet Your Specific Requirements

Whether a simple chemical feed system, a zeolite water softener, one of the many ion-exchange combinations, silica and CO_2 removal, or deionization for the highest quality water known today—you may be sure Elgin can provide the type of system required to produce water of the exact characteristics you need.

Ask for details or let us put our nearest representative in touch with you—Representatives in Principal Cities

THIS CHART TELLS THE STORY

A typical case study—from Armour & Company, Bartow, Fla.

WATER CONSTITUENTS	RAW WATER G.P.G.*	TREATED WATER G.P.G.*
Carbonate Alkalinity	9.00	1.57
Sulfate	0.78	8.21
Chlorides	0.70	0.70
Calcium	5.00	0.00
Magnesium	3.58	0.00
Sodium	1.90	10.48
Potential CO_2	137 ppm	<5 ppm
Dissolved Solids	10.48	10.48
Alkalinity Reduction		82.5%

*Ca CO_3 Equivalents

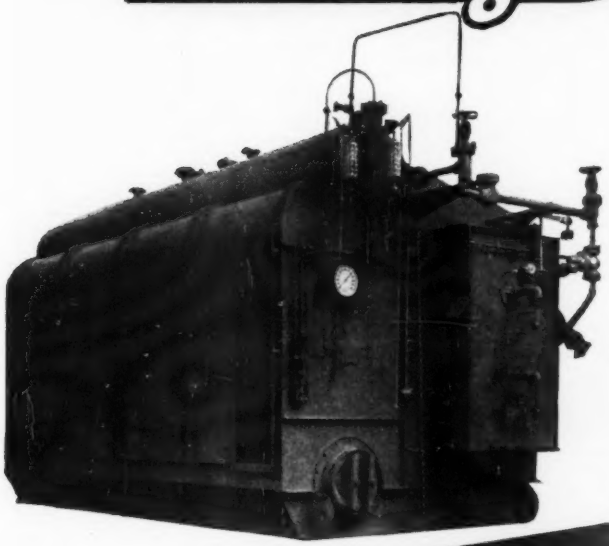
Why Not Obtain Comparable Improvement In Your Boiler and Process Water?

ELGIN
SINCE 1908
WATER CONDITIONING FOR EVERY NEED

ELGIN SOFTENER CORPORATION • 130 North Grove Avenue, Elgin, Illinois
In Canada: G. F. Sterne & Sons, Ltd., Brantford, Ontario

Vogt

Gas Fired
PACKAGE UNIT
Steam Generators
selected by
PHILLIPS CHEMICAL CO.
Pasadena, Texas Plant



TOP: One of the completed units prior to shipment.

BOTTOM: Shop erection view shows tile and block insulation in convection wall; also main baffle tile and furnace floor tile.

Principal Data, Each Unit

25,000 pounds steam per hour capacity. Induced draft type.

Fusion welded steam and water drums designed for 425 pound S.W.P.

Completely shop assembled and required only the piping and gas outlet connections to place them in operation.

Fully steel encased for outdoor installation on a simple foundation.

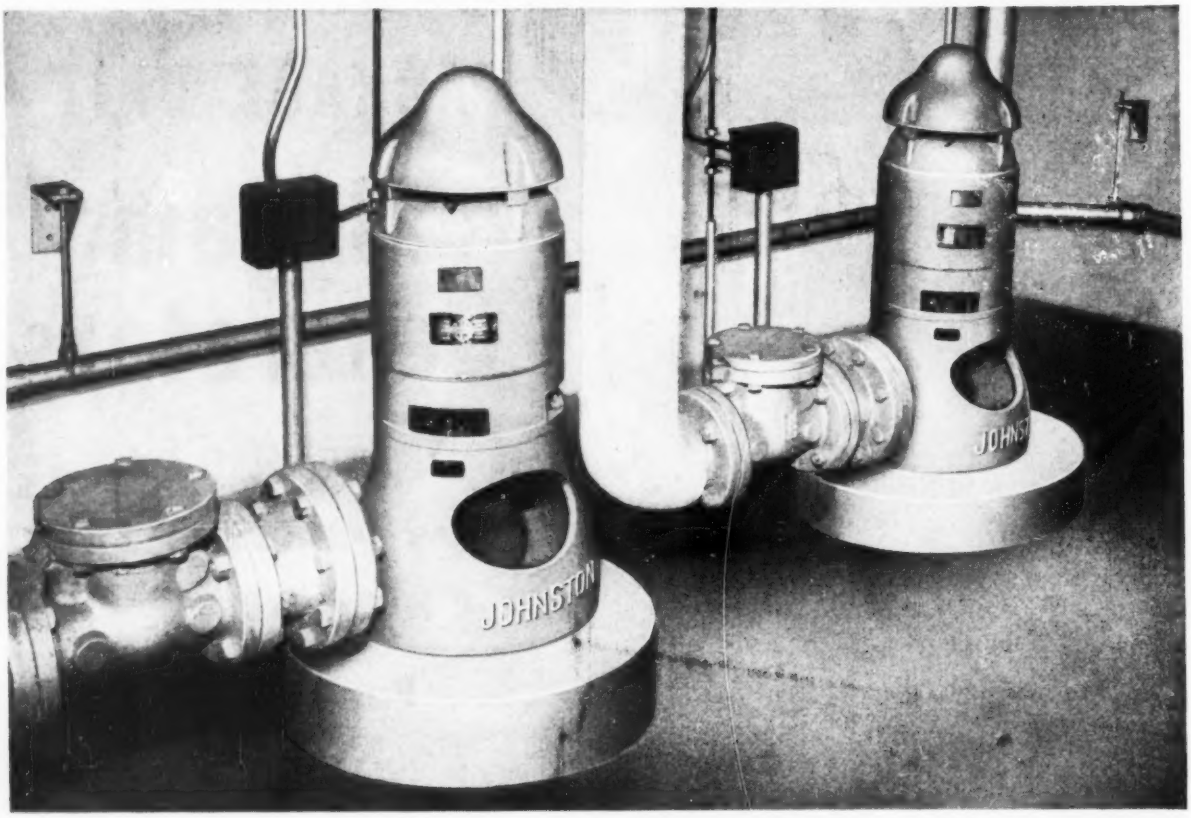
•

**Vogt Steam Generators are available in bent tube types and straight tube forged sectional header types for solid, liquid or gaseous fuels. Bulletins on request.*

HENRY VOGT MACHINE CO.
Louisville, Kentucky

BRANCH OFFICES: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

In All Kinds of Industrial Pumping Applications



JOHNSTON PUMPS ARE DOING A BETTER JOB...

Take this hot well installation, for example. Two Johnston Unit-Line, 3 horsepower, close-coupled pumps delivering 120 gallons per minute against a 65 foot head, were selected for this job, because . . .

1. **NO PACKING GLAND MAINTENANCE**
   An extra long throttle bearing and by-pass in the discharge case make a packing gland or mechanical seal unnecessary.
2. **NO BEARINGS TO LUBRICATE BELOW BASE LEVEL**
   Vertical, hydraulically balanced design eliminates radial thrust and consequent bearing and impeller wear.
3. **NO PRIMING NECESSARY**
   The open suction is submerged, thereby doing away with expensive priming devices used on other type pumps.

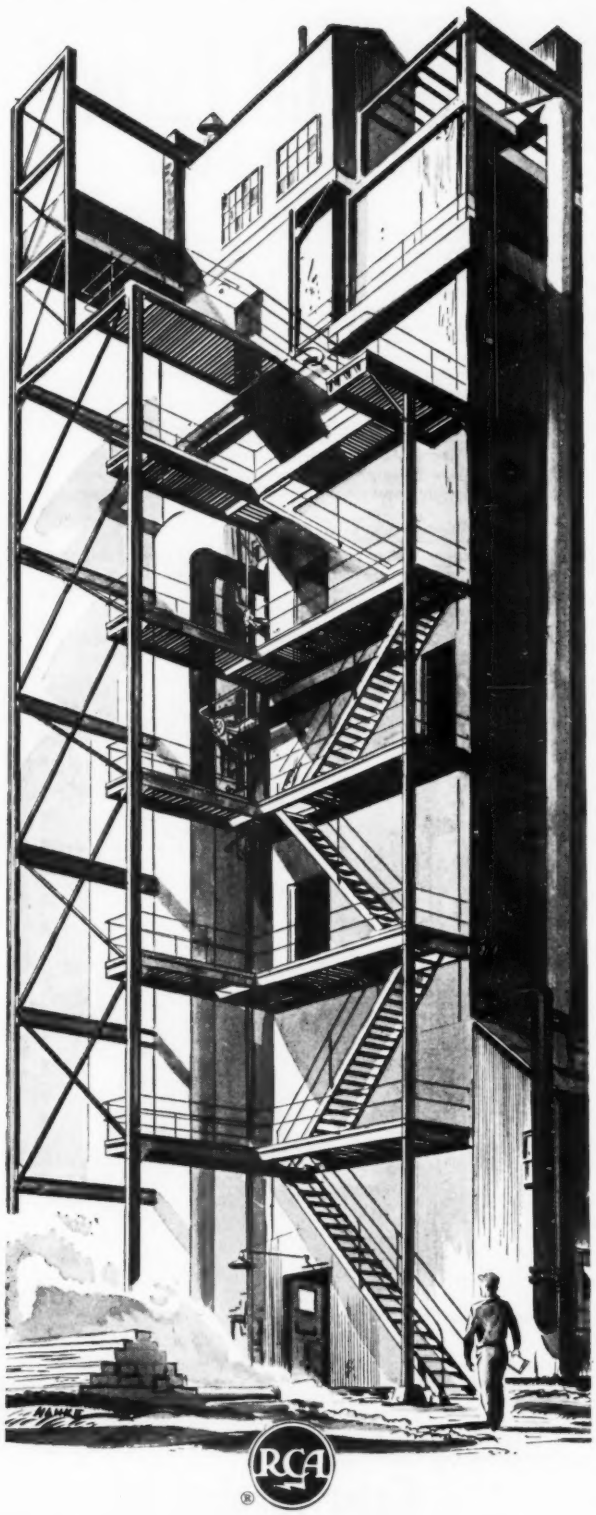
Just three of many reasons why Johnston equipment is handling all types of pumping jobs BETTER, in large or small operations. Why not let our trained engineering staff consult with you on the best solution to YOUR particular problem?

Send today for your free copy of our new bulletin about Johnston UNIT-LINE *Pumps. Ask for Bulletin G-75.*

JOHNSTON VERTICAL PUMPS

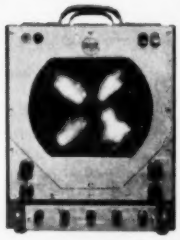
JOHNSTON PUMP COMPANY

3272 EAST FOOTHILL BLVD., PASADENA 19, CALIFORNIA



TOO HIGH *to get at?*

See it close up with RCA Industrial TV



WHEREVER operations are too remote for constant supervision—wherever you have to send a man to make periodic readings or checks—you need the continuous control of RCA Industrial TV.

DESIGNED FOR USE IN ANY LOCATION

RCA's rugged, compact Industrial TV camera—using the RCA Vidicon tube—measures only 3″ x 5″ x 10″, fits practically anywhere for close-up supervision. For hazardous locations, for indoor and outdoor applications where ambient temperatures are extreme—RCA now makes available a complete line of protective accessories—including: weather and explosion-proof housings; shock mounting; water-cooled camera lens; automatic iris control; remote panning; camera switching equipment.

For convenient monitoring the RCA Industrial TV monitor can be placed on a desk, or mounted in any standard meter panel.

SUPERB PICTURE QUALITY FOR CLOSE SUPERVISION

With RCA Industrial TV you have *continuous* visual control—far more reliable than periodic direct observations. And, *all* camera adjustments are made at the viewing monitor. RCA Industrial TV gives you a high-contrast, high-definition picture that's ideal for close control. (Scanning frequencies are 525 lines, 30 field, 60 frames interlaced.)

CHECK RCA INDUSTRIAL TV FOR WORKABILITY

Before you buy, get *all* the facts about Industrial Television. Check these important RCA features: two-unit chain, 110-volt, 60-cycle AC operation—two-knob control for all normal requirements—complete accessories.

In addition, check RCA's practical Service Plan—offering complete nation-wide service by the RCA Service Company.

FOR INFORMATION MAIL COUPON NOW

Industrial Products, Dept. 208S
RCA Engineering Products, Camden, New Jersey

Please send me information on RCA Industrial TV.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

INDUSTRIAL PRODUCTS

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT ***CAMDEN, N.J.***

In Canada: RCA VICTOR Company, Limited, Montreal

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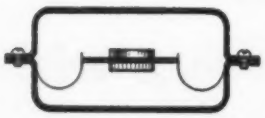
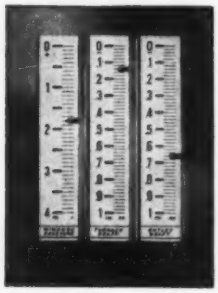
• ELLISON

Straight Line Draft Gage





Special Synthetic Coated Silk Fabric Diafram Lasts for a Generation.

- Non-parallax pointer—always true readings regardless of elevation.
- Translucent ceramic scale—accurate, everlasting.
- Unitized construction—mechanism readily slides out front of case.

Plus 10 Other Features described in Bulletin 124.

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547 W. MONROE ST. Since 1896 CHICAGO 6, ILL.

THE ELLISON LINE ALSO INCLUDES:

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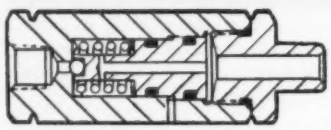
ELLISON INSTRUMENTS—Outstanding Design, Construction and Accuracy

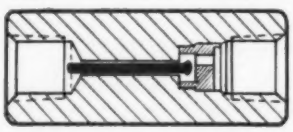
REPUBLIC VALVES

INDUSTRIAL • CHEMICAL • AIRCRAFT



REPUBLIC GAGE PROTECTOR

PROTECT your expensive gages from severe pressure fluctuations and shock with Republic gage protectors and snubbers. Designed for a wide range of settings and service conditions. Standard units are brass, with pipe thread connections as shown. Other materials and connections are available on special order. Gage protectors fit standard gage connections, 15 to 5,000 psi.



REPUBLIC PRESSURE GAGE SNUBBER

Write for complete catalog and nearest distributor.

RM REPUBLIC MANUFACTURING CO.

1930 WEST 77TH STREET • CLEVELAND 2, OHIO

6 Essential Facts

for a company with a Water Problem...

1. Costs Far Less to Install!

A Ranney Water Collector will add millions of gallons to your daily water supply—at a fraction of the cost of conventional systems!

2. Less Expensive to Operate!

A Ranney Water Collector is far less expensive to operate—uses fewer pumps, fewer personnel, less power, and usually requires no treatment facilities.

3. Maintenance Requirements Practically Nil!

A Ranney Water Collector requires little or no maintenance. The rate of flow through the Ranney Collector's apertures eliminates clogging and silting. No filter plant maintenance.

4. More Water per Unit!

A single Ranney Water Collector has produced more clear, cool water than ten conventional vertical wells.

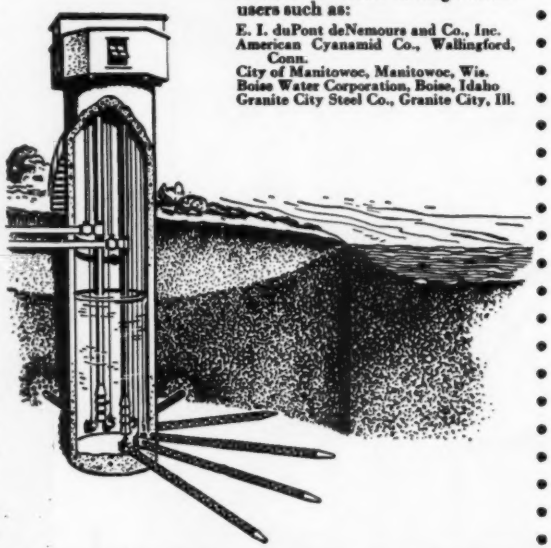
5. Far Longer Life Cuts Depreciation Costs!

The longer life of a Ranney Water Collector lowers financing and depreciation rates appreciably.

6. Ask These Satisfied Users

Ranney Water Collectors are currently rendering excellent service to scores of large water users such as:

E. I. duPont deNemours and Co., Inc.
American Cyanamid Co., Wallingford, Conn.
City of Manitowoc, Manitowoc, Wis.
Boise Water Corporation, Boise, Idaho
Granite City Steel Co., Granite City, Ill.



An inexpensive Ranney survey will determine how the Ranney Method can work for you.

If you need water, write us for complete information on how a Ranney Water Collector will solve your problem.

Ranney Method Water Supplies, Inc.

HYDROLOGISTS AND WATER SUPPLY CONTRACTORS

Executive and Engineering Offices
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"MODERN PLANT HANDBOOK": This *extra* issue in September brings details on 500 new steam and hydro plants; capacity, design, equipment — 200 modernization ideas for new economy and efficiency — directory of power equipment, who makes it — directory of *former* manufactories and successors — Products Show Case.

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Power

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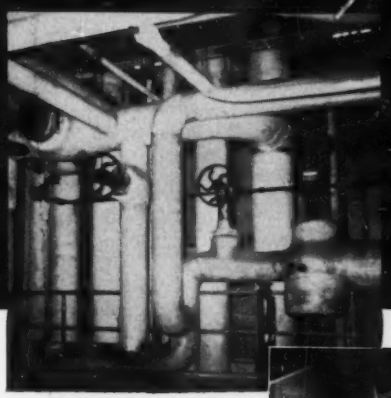
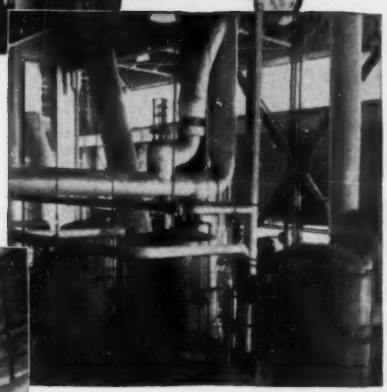
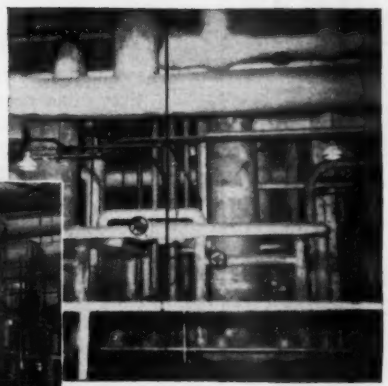
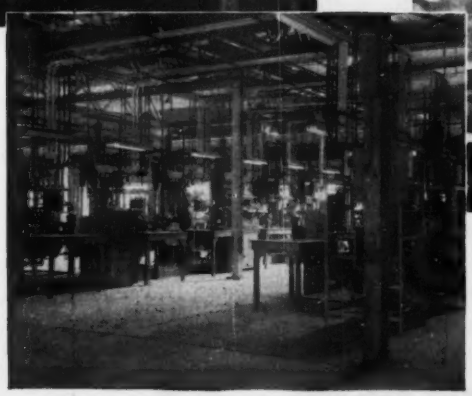
POWER PIPING that fits like a glove









That is why Blaw-Knox is so often selected to do critical jobs. Whether it's for power or processing, we are well aware that piping requires the specialized knowledge of both engineer and designer as well as the skill and experience of the fabricator. Here you will find the facilities, the staffs, the equipment and the *incentive* to handle any size piping job quickly, authoritatively, economically. And the results speak for themselves during installation as well as over the years ahead.

BLAW-KNOX

BLAW-KNOX COMPANY
POWER PIPING AND SPRINKLER DIVISION
PITTSBURGH 33, PA.

NEW JERSEY PROCESS PLANT SAVES NEW FEED PUMP COST

Expansion plans called for a new boiler, and the Chief Engineer thought he'd need a new feed pump too. Pumps on hand — two 10 x 6 x 10's — often needed repairs to meet existing demand. Leaking valves kept them below capacity most of the time. He tried Sims Pump Valves before the new installation was completed and found, even at slower speeds, his pumps still supplied all the water necessary. When the new boiler was put on the line, the same pumps with Sims Valves carried the load easily.

Three years later the Chief said, "Sims Valves were a good investment." They were — but he couldn't lose anyhow. Sims Valves were *guaranteed* to give him better performance — complete satisfaction.

See how Sims valves can help with your pump problems. Carried in stock to fit over 40 different makes of reciprocating pumps — and hundreds of sizes — they'll fit your pumps — improve performance. Free catalog shows how.

SIMS
PUMP VALVE CO. INC.
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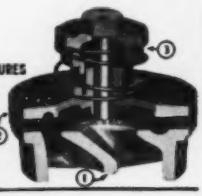
M & M BLDG. HOUSTON, TEXAS

...Only **SIMS** HAS THESE PATENTED FEATURES

1. Inclined ribs, which help increase pump capacity 30%.
2. Valve disc that rotates every time it lifts.
3. Double shock-absorber stem head.



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TYPE IHD EXHAUST FAN
For factories, mills, theatres, schools, hotels etc. Features belt drive with ball bearing motor. Sizes from 24" to 72".

Write for Catalog No. 400. Complete data and specifications on fans and blowers for every industrial and commercial application—address Dept. S-7.

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and quality of workmanship, reduce industrial accidents and employee fatigue with proper ventilating and cooling equipment. **CHELSEA** Fans remove excessive heat, fumes, dirt, dust and grit, also dead stale air. 30 models, in over 200 sizes, are available, and each fan or blower is especially engineered and tested for its recommended application. All ratings are certified by P.F.M.A. test methods to insure proper performance.

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36,000 feet of ALCOA Aluminum Coiled Tube serves air, dried by Alcoa *Activated** Alumina, to catalytic cracking unit at the Anderson-Prichard Oil Corporation, Arkansas City, Kansas. Partially exposed to hydrogen sulfide, tubing shows no corrosion, has required no maintenance since installation in September, 1952.

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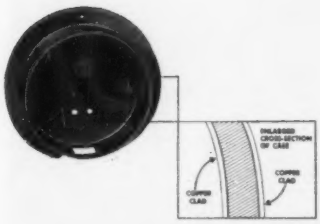

Another first for Marsh

Here is a case in keeping with the "Conoweld" tube. Another recent Marsh development, it is called the

New *Marshalloy* Case

It is a copper-clad wrought steel case of boiler plate thickness, four times as strong, and one-third lighter than conventional cast iron cases. Copper surface makes it as non-corrosive as a plastic or die-cast case. Handsome, corrosion-resistant, satin black enamel and Marsh safety blow-out plug are the finishing touches.

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NEW MARSH *"Conoweld"* TUBE

This time we have made the best part of the best Marsh gauge still better. We have gone into the part that actually does the work — the socket and tube — and have made it permanently leak-tight from inlet to tip of tube.

We have done this by fusing the tube into the socket and the tip to the tube so that the whole assembly is truly *one piece*. The photo of one of the sockets sawed in half shows the perfect fusion of the vital joint. Tests and photomicrographs prove the perfection of the fusion.

Developing the fusing process called for extensive research. The method as finally perfected — the "Conoweld" process — involves first fusing the tube to the socket and end-piece; then tempering the tube to required resiliency.

Yes, it is these dramatic departures from beaten paths that have achieved leadership for Marsh gauges and are ever increasing that leadership. Ask for latest information covering gauges for all services.

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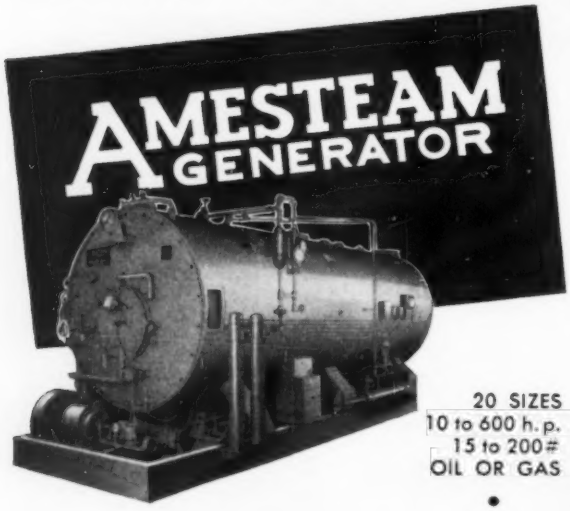

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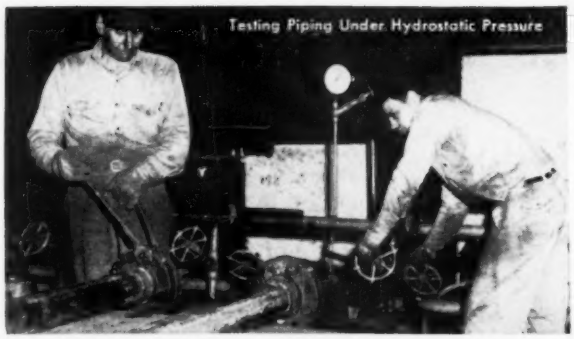

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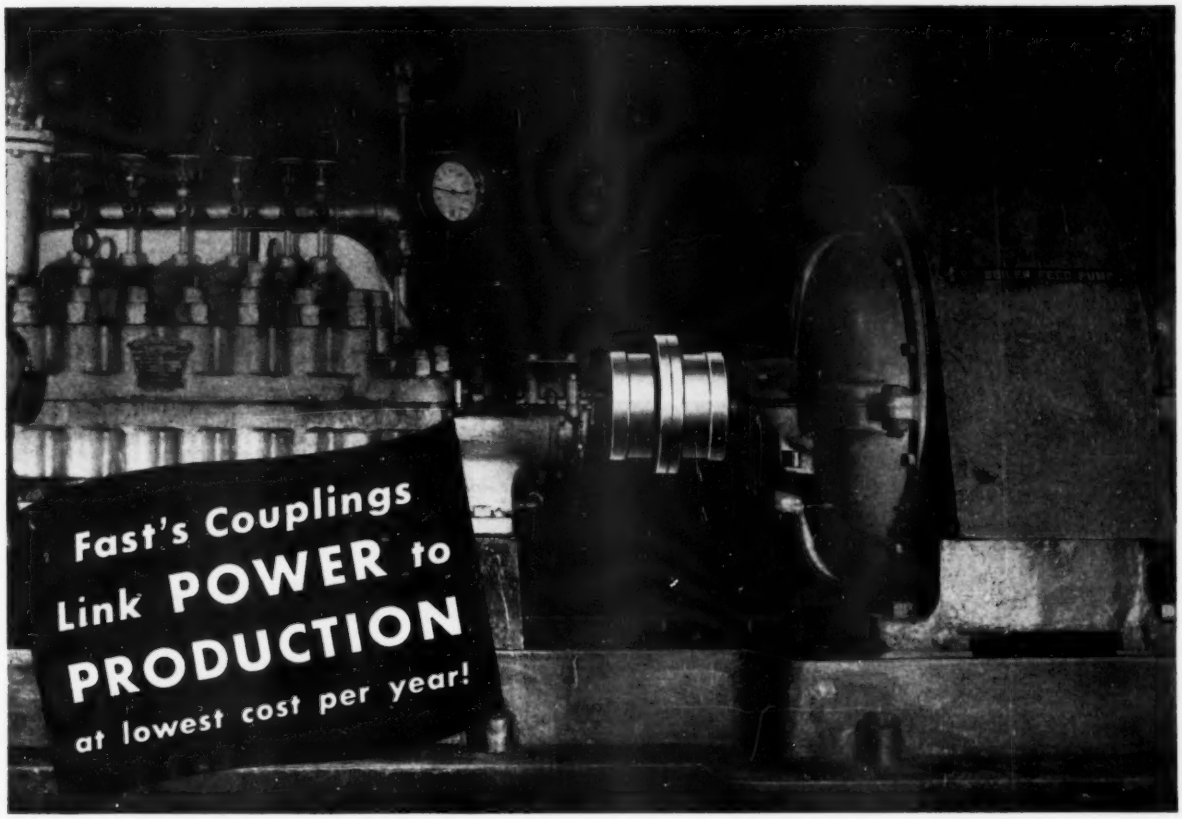

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THROUGHOUT industry, Fast's are rated the most dependable couplings on the market . . . to the tune of over half a million now in service! Year in, year out, they continue to *outlast the equipment they connect* . . . save time, maintenance and money by eliminating costly coupling failures.

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Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

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Company .....
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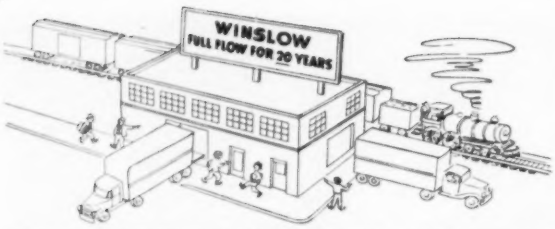
City ..... *Zone* ..... *State* .....



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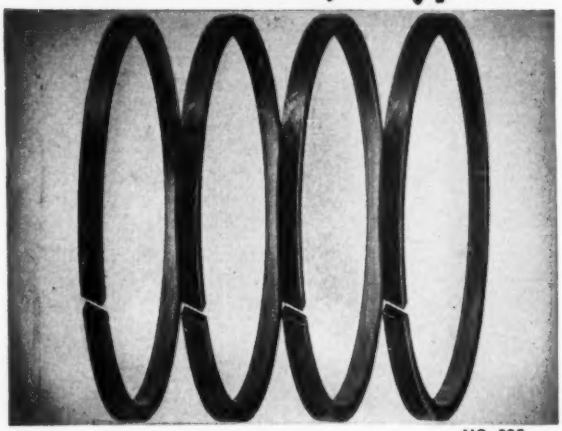


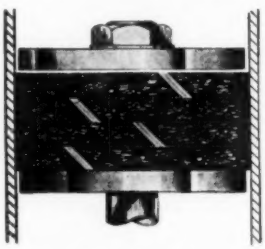
NO. 528

SEA-RO "Graphitized" Pump Plunger Rings

for high temperatures and pressures

Sea-Ro "Graphitized" Pump Plunger Rings No. 528 are manufactured of a laminated phenolic composition specifically engineered to meet the need for a long wearing, low friction, resilient, light weight ring able to withstand high pressures and temperatures.

Being of the floating type, Sea-Ro No. 528 rings reduce wear on the cylinder liner. They require no follower pressure to maintain close contact with the cylinder wall. When correctly installed, they will give satisfactory operating conditions equal to the service obtained with snap rings on steam pistons.



Applications

Pump plungers working against fuel oil, lubricating oil, gasoline, naphtha and other distillates, alkalies, caustics, reagents, hot and cold water (fresh or salt) or any liquid not containing sand or abrasives at normal temperatures and pressures.

Consult our engineering department about your pump packing problems. Send for catalog of products and engineering data.

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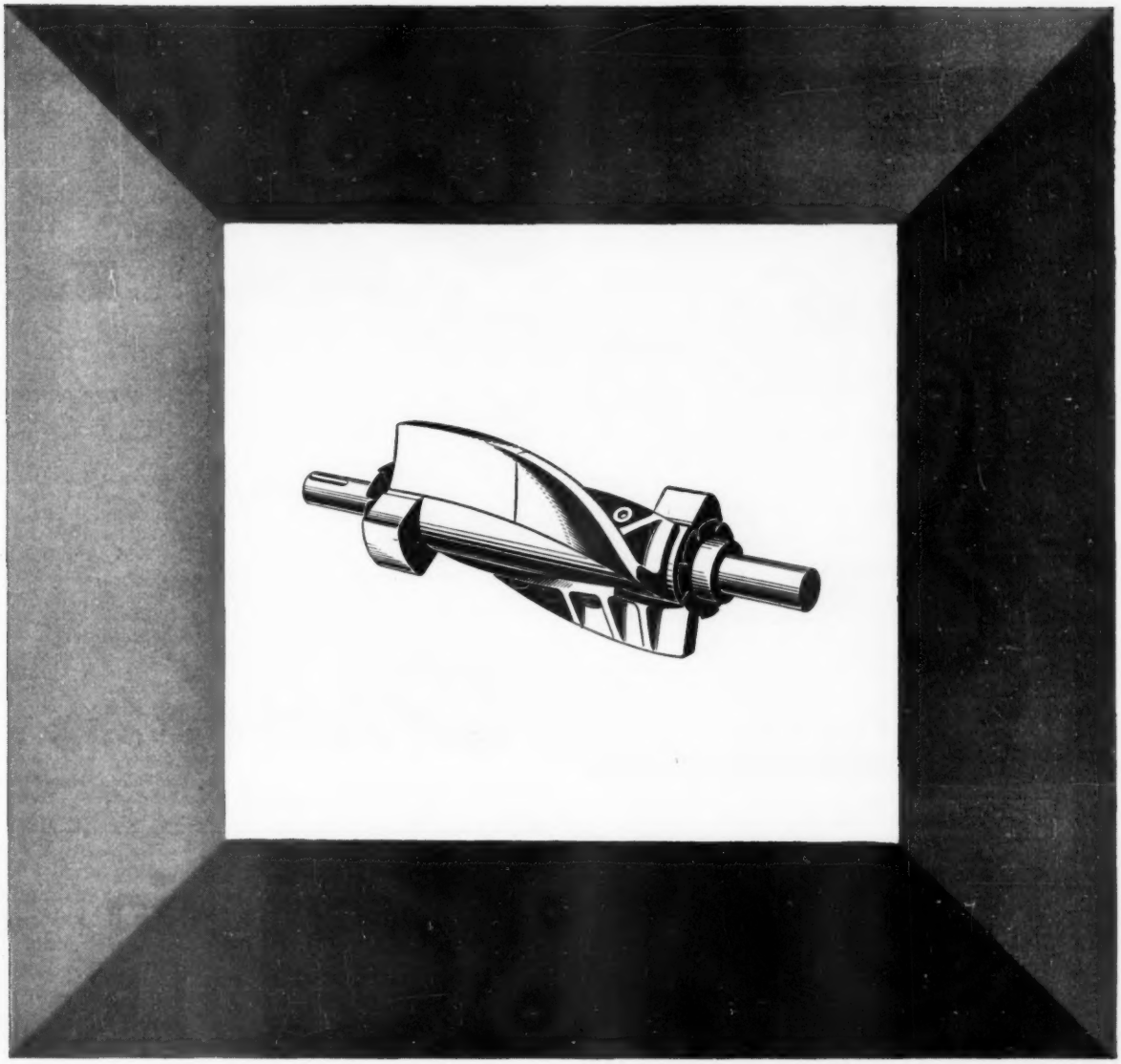
SEA-RO — PUMP PLUNGER RINGS NEK-SEAL PACKING

SEA-RO PACKING CO., INC., WOOD-RIDGE, N.J.



How to make a stoker with Perfect Spread

WHETHER YOU PLAN to buy a new unit or to re-stoker an old one, it must be engineered to assure top efficiency with both low and high ash coals. And a prime requisite for such efficiency is *even* coal distribution over the entire grate . . . the perfect spread that is provided only by American Engineering's unique spiral overthrow rotor.

Supplementing that, you need the exclusive Perfect Spread traveling conveyor feeder that *won't clog . . . not even on wet coal.* This feeder operates on a high traction principle that provides true, *continuous* feeding throughout its whole range of 50 to 7500 lbs. of coal per hour. And for maximum combustion . . . most steam per fuel dollar . . . the special AE cinder return and adjustable overfire air system are unsurpassed.

Perfect Spread Stokers are available in a wide choice of sizes, capacities and grate types. Ask to have an American Engineering Company representative call and discuss your exact requirements.

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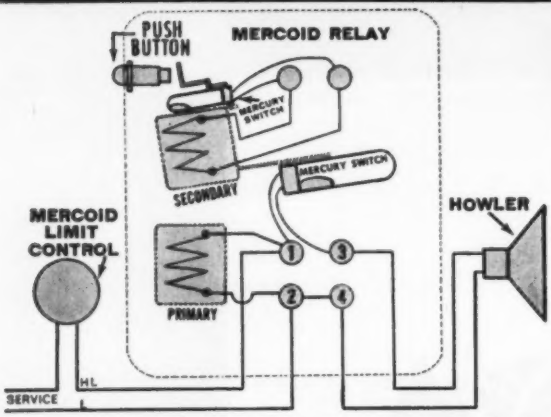
MERCOID RELAY FOR AUDIBLE ALARM

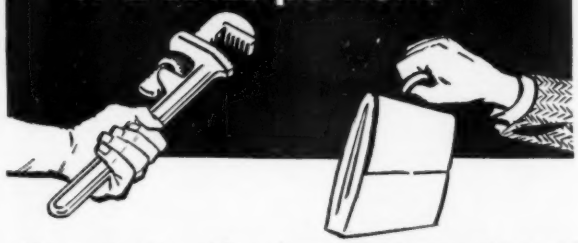


When Limit Control closes its circuit, current is supplied to primary coil of Mercoid Relay and through the normally closed mercury switch to the "Howler" (alarm). To stop "Howler," operator pushes in "push button" which manually raises relay secondary and breaks circuit to "Howler." Secondary is held up by magnetic repulsion until condition is corrected. When limit control opens the primary circuit of relay, secondary coil drops to normal position and relay is automatically ready for another operation.

WRITE FOR BULLETIN CA-8R

THE MERCOID CORPORATION, 4201 BELMONT AVE., CHICAGO, ILL.

To the man who wants to trade his pipe wrench for a sales portfolio



If you are 30 or older... have several years of power plant experience... *really know* boiler operation... and have a desire to improve your position, we'd like to hear from you.

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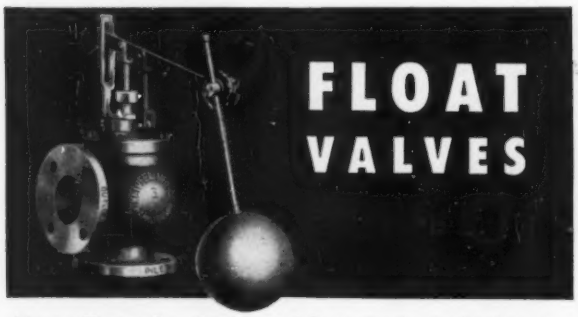

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No. 77 illustrated — Single seated float valve for dead end service. Internal pilot control. 250 lbs. max. inlet pressure. Does the job of more complicated control valves at a much lower cost wherever tight closing float valves are required for make-up water control. Sizes 2" — 8". Other types. Get BULLETIN 349.

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K-139

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Coming in OCTOBER: *Power's*

SPECIAL REPORT ON ELECTRICITY IN TODAY'S PLANT

Over 170 men in more than 40 plants in 11 states were interviewed in the preliminary field work for this 48-page study.

Watch for it—it will be fully up to Power's excellent standards in coverage, organization and illustration.

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DEPRECIATION

And Its Crucial Economic Role

The sixth annual McGraw-Hill survey of Business' Plans for New Plants and Equipment, just completed, reveals some remarkable facts about the role of depreciation in our economy. To most people, depreciation is a technical term, used by accountants to discuss a dull subject. But it really is a simple matter: It is the amount of money set aside each year by a company to replace plant and equipment that is wearing out. And here are some facts from this survey* which show how depreciation can make the difference between prosperity and recession in the United States:

1. *In 1953, about half of all the money spent on new manufacturing plants and equipment will come from depreciation reserves.* For the future, manufacturing companies are relying even more heavily on this source of money. In the years 1954-56, they count on using their depreciation funds to pay for almost two-thirds of the new plants and equipment now planned.

2. *The amounts of money made available by depreciation allowances vary greatly from industry to industry.* Some industries, such as those producing steel, chemicals and petroleum products, will have relatively large amounts of cash available from their depreciation reserves. In considerable measure, this is because the government is allowing them to accumulate such reserves at an accelerated rate as an encouragement to build facilities required for national defense. Bu. most of the companies engaged in the production of textiles, processed foods and many kinds of machinery have had little chance to benefit by this provision for accelerated depreciation. Hence, they have much less money available from depreciation reserves.

3. *There is a definite shortage of investment funds in the industries that have relatively low depreciation allowances.* Taken together, the coal mining, textile, food processing, machinery and other metal-fabricating industries plan to spend about $4.7 billion for new plant and equipment this year. But they report that they would spend $1.5 billion *more* per year during the period 1954-56 if sufficient funds were available.

4. *Eighty-five per cent of the manufacturing companies covered by the survey reported that they plan to invest all their depreciation funds* to keep equipment up-to-date and to provide capacity for new products and new markets. These companies could let their depreciation funds pile up as idle cash. But the intention is to spend most of them for capital equipment.

*The sixth annual McGraw-Hill survey of Business' Plans for New Plants and Equipment included companies that provide 25 per cent of all industrial employment and 60 per cent of employment in those industries where capital investment is highest. These companies are mostly the larger companies in their respective industries. A copy of the full report of this survey can be obtained by addressing: Department of Economics, McGraw-Hill Publishing Company, Inc., 330 West 42nd St., New York 36, N. Y.

Hence, there is a direct relationship between the amount of depreciation funds available and the level of capital investment. And it is upon the latter that the level of general prosperity decisively depends. One-third of all industrial workers are engaged in producing or installing such equipment.

This fact that the level of depreciation allowances has a major bearing on the level of capital investment should not surprise anyone. In several foreign countries where these allowances have been increased, investment has boomed. The two nations with the highest ratios of investment to national income are Canada and Norway. Both countries adopted flexible depreciation policies after World War II. In Sweden and The Netherlands also, flexible depreciation allowances have contributed to rapid industrial expansion. Finally, the tremendous investment brought about by our own rapid amortization program shows dramatically the importance of depreciation in stimulating capital expenditures.

Obsolete Tax Laws

In spite of this record, the fact remains that our laws and the business procedures that govern depreciation allowances — in particular the laws and rulings that govern the deduction of depreciation from taxable corporate income — are still based on antique and obsolete accounting concepts which take no account of depreciation's dynamic role in our economy. The internal revenue code still requires most companies to depreciate their equipment over a long period, even though these small annual allowances cannot possibly pay for the investment that is necessary to keep a plant up-to-date under today's rapidly changing technology, with its production of new and improved machinery.

The only allowance made by the government for rapid depreciation is that which is authorized for certain types of plants during the defense emergency. Under this policy most companies are unable to use accelerated depreciation for tax purposes. And as defense projects are completed, the number of new authorizations is dropping. We may lose the chance to utilize fully this powerful tool for sustaining investment because, under our ramshackle emergency tax structure, accelerated depreciation is available only to a minority of firms on a temporary basis.

New Policy Needed

A sensible, up-to-date depreciation policy for tax purposes is long overdue. Either the Treasury must modernize the internal revenue code on its own initiative, or Congress must take the lead by writing into permanent law a flexible depreciation policy applicable to all companies.

Treasury experts now have before them a number of proposals to allow faster depreciation for the average firm. The U.S. Chamber of Commerce has suggested that companies be allowed to deduct from taxable income 25 per cent of the cost of new equipment in the first year, with the remaining cost to be deductible over the life of the facilities. The Machinery and Allied Products Institute has long sponsored a formula that would allow full deduction in two-thirds of the estimated life of the property. In Congress, Chairman Reed of the Joint Committee on Internal Revenue Taxation has stated that we need a more flexible depreciation policy. Senator Frear of Delaware has introduced a bill that would let a business make its own choice on how fast to depreciate its equipment.

It will take time and study to determine which of these various proposals best fits the needs of the economy without sacrificing unduly the revenue needs of the government. If we are to have a new depreciation policy, designed for a long period ahead, it must be carefully worked out. But this much is clear right now: *The development of a flexible depreciation policy on the part of the federal tax authorities is one of the most important steps that can be taken to sustain prosperity. When we talk about depreciation, we are talking about the money that pays for almost two-thirds of the new manufacturing facilities now scheduled for construction. We are talking about the new investment and the new jobs on which our continued prosperity depends.*

McGraw-Hill Publishing Company, Inc.

TEACHING POSITIONS IN ISRAEL

The Israel Institute of Technology, Haifa, Israel, proposes to appoint: 2 Professors of Electrical or Electronic and Telecommunication Engineering with special qualifications in Power Engineering; 1 Associate Professor in Electrical Power Engineering.

Applicants should have first-rate professional and academic qualifications, be willing to integrate themselves into the life of the country and, in due course, to teach in Hebrew.

Applications with full details should be sent, for transmission to Haifa, to:

THE AMERICAN TECHNION SOC.
1000 Fifth Ave., New York 28, N. Y.

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION VACANT

(Additional Position Vacant Advertising on the opposite page.)

ELECTRICAL MAINTENANCE Foreman: A Central Pennsylvania brass mill with 1350 employees has an opening for a graduate Electrical Engineer with five years' experience in electrical maintenance, layout, installation; or equivalent through special training and experience. Age requirement: 25 to 45 years. Salary $6,000—up, with related employee benefits. P-8178, Power.

SELLING OPPORTUNITY OFFERED

WANTED A Salesman for nationally known Pipe Fabricating and Erecting Company. College Graduate in Engineering—plus knowledge of the piping industry required. Person desired: Approximately 35 years of age and willing to do extensive traveling. Good Salary and Expenses. SW-7548, Power.

EMPLOYMENT SERVICE

SALARIED PERSONNEL. $3,000-$25,000. This confidential service established 1927 is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

LICENSED CHIEF Engineer, Age 32. 6 years operations, 4 years construction. Desires position, prefer southwest. PW-8093, Power.

STEAM PLANT operating engineer, age 43. 10 years experience. Operate, maintain complete modern steam plant. PW-7971, Power.

SELLING OPPORTUNITY WANTED

ESTABLISHED SALES Engineer organizing Manufacturer's Agency Southern California. Financially responsible. Offer aggressive and highest type technical representation. Desire related lines as pumps, valves, steam specialties, power and process piping products. RA-8158, Power.

WANTED

ANYTHING within reason that is wanted in the field served by Power can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

NEW "SEARCHLIGHT" ADVERTISEMENTS

received by July 9th will appear in the August issue subject to limitations of space available. Address copy to the

Classified Advertising Division

POWER
330 W. 42nd St., New York 36, N. Y.

WANTED
ASSISTANT CHIEF ENGINEER

Graduate Mechanical, Chemical or Civil Engineer for complete charge under Chief Engineer of 3500 KVA diesel generating plant; all shops; foundry; mobile equipment including loading, marine, railway; construction; maintenance of all types equipment at property. Must have natural mechanical ability, be good organizer with excellent practical and supervisory references. Also construction experience.

Age limits 33-45. Three year contract with 3 months' paid vacation at completion contract and two 1-week local leaves after first year. Furnished house and partial utilities supplied free. Free transportation self and family. Free hospital and medical. Free schooling to 14 years. Non-contributory pension plan. Report single status six months. Require complete record and references. Photograph optional. Location—Mediterranean. Large Copper Mine. Salary open.

P-8246, POWER
1111 Wilshire Blvd., Los Angeles 17, Calif.

MECHANICAL ENGINEER

Graduate mechanical engineer experienced in public utility steam plant operations required by progressive public utility company in Central America as Supervisor of 7,000 KW Steam Station. Must be qualified to handle men, operating and maintenance problems. A good working knowledge of Spanish a requisite. Preferred age range 30-45. Attractive salary. Good living and working conditions. Splendid opportunities for right man. Write giving age and fullest details of qualifications and experience.

P-7953, POWER
330 W. 42nd St., New York 36, N. Y.

MINIATURE STEAM ENGINES

Well-known manufacturers wish to contact any firm or person possessing a design patented or otherwise of a miniature steam engine and evaporator in one unit, to provide up to ¼ h.p. on shaft at governed speed about 2000 R.P.M. Engine must incorporate flash or very low water content evaporator and the whole must be extremely compact and cheap to operate as sealed unit without lubrication or regulation. Thermal efficiency minimum 10% at 20° C. ambient. A closed cycle using high boiling point fluid not excluded. Advertisers only interested in mature and highly competent professional propositions and are fully familiar with the commonplace design solutions.

BO-8272, POWER
330 W. 42nd St., New York 36, N. Y.

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No correspondence school bother. Nationally-known Chief Stationary Engineer Frederick C. Walker's 100-Question, 100-Answer Bulletins give you the straight dope quick. Send $3 to Walker & Collins, 524 Ashland Ave., Buffalo 22, N. Y. for first set today. Keep working. Save year.

INTAKE SCREEN

1—Link-Belt Model #46 Vertical traveling "Clean Water" Intake Screen 16'-6" centers, trays 72" wide with front spray. Capacity for screening 12,000 gallons water per minute at velocity of 1.9' per second through 100% clean screen cloth with water in screen at low level of 4'-8".

This is a new screen. It has never been used. Available for immediate shipment. For complete details and price WRITE

P. H. GLATFELTER CO.
Spring Grove, Pa.

FOR SALE

ONE DOYLE & ROTH #1468-14
Horizontal Shell and Tube Heat Exchanger

The unit is constructed of 14" steel shell, steel tube sheets, steel baffles, ¾" O.D. x .065 seamless steel tubes. The front channel is arranged for eight passes and has two 1½" flanged connections, one top inlet, one bottom outlet. Shell connections are 1" flanged inlet and outlet for water, ¾" IPS vent, 1" IPS drain. Overall length of unit approximately 15' 10".

THE MENNEN COMPANY
Hanover Ave. Morristown, N. J.

FOR SALE
STEAM ENGINE

One (1) Used Allis Chalmer 150 PSI—18 x 20 Steam Engine with 127 KVA (Alternator) Generator and 175 KW (Exciter) Generator. Contact:
Mr. Henry S. Kubes
THE AMERICAN BOX CO.
1900 West Third St., Cleveland 13, Ohio

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WANTED
8000 to 10000 H.P. MOTORS A.C.

Any Speed or Volts

W-8273, POWER
330 W. 42nd St., New York 36, N. Y.

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No lengths too long or too short
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WANTED

1500 KW, 3 Phase, 60 Cycle, 480 Volt Condensing Type Turbine Generator. Initial Pressure 235 p.s.i., 500° F.T.T., Extraction Pressure 25 p.s.i.

W-8249 POWER
330 W. 42 St. New York 36, N. Y.

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✓ Complete Stock A.C. & D.C. Motors and Generators

✓ New and "Certified Rebuilt"—UP to 1000 H. P.

SPECIAL PURCHASE!

2—DC 55 V. 3600 Amp. M-G Sets

Input—300 H.P. Whse. synch. motor, 3/60/220/440 V. 720 RPM, w/exciter.

Output—200 KW. generator, DC 55 V. 3636 amp. 720 RPM, w/exciter.

A. C. GENERATORS — 60 CYCLE

KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn. cond.		4000/2300	900
625	Gen. Elec.	ATB	2300	450
625	G. E. 25 cycle	ATB	2300	750
600	Gen. Elec.	ATB	480	900
625	El. Machy.	Late	240/480	1200
485	Allis. Ch.	1 brg	480	400
350	El. Machy.	1 phase.	480	1200
312	Gen. Elec.	ATB	240/480	600
275	G. E. 25 cycle	ATI	480	750
225	El. Machy.		480	720
225	Gen. Elec.	ATI	240/480	900
150	Whse.		2300/480	600
125	Gen. Elec. (2)	ATB	240/480	900
112	Gen. Elec.	ATB	240/480	900
90	Gen. Elec.	ATI	240/480	1200
75	Gen. Elec.	ATI	240/480	1200
75	El. Machy.		2300	900
56	G. E.	ATB	240/480	1200

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Al. Ch.	MECW	125/250	1200
250	Allis. Ch. b.b	EW	350	1200
150	Whse.	SK191	125/250	900
125	Gen. Elec.	RC	250	1800
125	Gen. Elec.	RC38	250	675
105	Century b.b.	1500 amp.	70	1200
100	Allis. Ch.	E	125	1200
75	Gen. Elec. (2)	CD115	250	1500
75	Whse.	SK	250	1200
60	Whse.	SK160	250	1000
50	Whse.	SK	250	1100
50	Allis. Ch.	EW	125/250	1200
50	Gen. Elec.	RC	125	1200
40	Gen. Elec.	RC	600	1750
25	Whse.	SK93	125	1750
20	Gen. Elec.	RC	125	1150
15	Star b.b. (10)	SQ	250	1500

D.C. MOTORS

HP	Mfr.	Type	Volts	Speed
300	Gen. Elec.	MPC	250	500
300	Allis. Ch. b.b.	EW	350	1000
200	Al. Ch. b.b.	E	250	500/1000
150	Gen. Elec.	RC36	230	1700
150	Gen. Elec.	RC39	230	550
100	Whse.	SK	230	850
75	Whse.	SK170	230	635
75	G. E. (2)	CD 115	230	1150
75	Whse.	SK163	230	850
60/75	Gen Elec.	C	230	500/1200
50	Whse.	SK133	230	1150
50	Whse.	SK150	230	750
50	Reliance b t	65IT	230	750
50	Gen. Elec.	CD123	230	550/1200
50	Gen. Elec.	RC33	115	1100
35	G. E.	RF-14	230	250/1000
30	Imperial b.b.	D69	230	400/1600
30	Gen. Elec.	LC	230	500/1500
30	Whse.	SK110L	230	1150
30	Star b.b. (3)	SB	230	1750
25	Whse.	SK150	230	3 0/1200
25	Gen. Elec.	CD85	230	1750
25	Gen. Elec.	CD105	230	/1725
20	Century bb.	DN336	230	3500
20	G. E. series	CO-1826	230	875
20	Whse. b.b. (2)	SK97	550	900

A. C. MOTORS

HP	Mfr.	Type	Volts	Speed
800	G. E.	Slipring	2300	400
750	Whse.	Synch.	2200/4000	900
700	G. E.	Synch.	2200	514
650	E. M.	Synch.	480	1200
500	G. E.	Sq. Cage	6600/4,000	1800
500	G. E.	Synch.	440	900
500	G. E.	Slipring	2200/440	450
500	Al. Ch.	Synch.	440	400
450	Whse.	Synch.	2300	900
400	Whse.	Sq. Cage	2200	514
400	G. E.	Synch.	440	450
400	Allis. Ch	Sq. Cage	2200	1200
350	G. E.	Slipring	2200/440	300
350	Whse.	Slipring	2300	450
300	Gen. Elec.	Slipring	2200/440	720
300	Al. Ch.	Sq. Cage	2200/440	720
300	El. Mach.	Synch.	2200	360
300	Whse.	Synch.	2200/440	600
300	Al. Ch.	Slipring	2300	514
300	G. E.	Slipring	440	360
250	G. E.	Slipring	2300	450
250	G. E.	Slipring	440	600
250	Whse. (2)	Sq. Cage	2200/440	1200
250	L. A. (2)	Sq. Cage	2200	1800
225	G. E.	Synch.	220/440	900
200	G. E. TEFC	Sq. Cage	440	1800
200	Gen. Elec.	Sq. Cage	2200/440	720
200	G. E.	Slipring	220/440	514
200	G. E.	Sq. Cage	220/440	600
200	Cr. Wh.	Sq. Cage	220/440	3600
200	Whse.	Sq. Cage	2200/440	900
200	G. E.	Slip Rings	220/440	600
200	E. M.	Synch.	220/440	1200
200	G. E.	Sq. Cage	220/440	1200
200	G. E.	Slipring	220/440	360
200	G. E.	Sq. Cage	220/440	1800
200	Rel. b.b.	Sq. Cage	220/440	1200
200	E. M.	Synch.	220/440	514
160	Whse.	Synch.	220/440	600
150	G. E. TEFC	Sq. Cage	2200	3600
150	Allis. Ch.	Slipring	2200/440	720
150	G. E. (2)	Sq. Cage	2200/440	720
150	G. E.	Slipring	220/440	450
150	Allis. Ch.	Sq. Cage	2200/440	1200
150	Rel. b.b.	Sq. Cage	220/440	1800
125	G. E. (2)	Slipring	220/440	600
125	G. E.	Slipring	220/440	450
125	E. M. (2)	Synch.	220/440	1800
125	Allis. Ch.	Sq. Cage	2200	900
125	G. E.	Slipring	2200/440	720

M-G SETS

KW	Mfr.	Input V	Output V
500	Whse.*	2300 AC	250 DC
300	Allis. Ch.	2200/440 AC	5/250 DC
300	Whse.*	2300 AC	600 DC
250	Allis. Ch.	2200/440 AC	350 DC
250	Cr. Wh.*	2200/4000 AC	250 DC
200	Whse.*	2200/4000 AC	250 DC
200	Whse.* (2)	220/440 AC	55 DC
200	G. E.*	220/440 AC	250 DC
200	Gen. Elec.*	220/440 AC	125 DC
150	Whse.*	220/440 AC	125/250 DC
125	Gen. Elec.	220/440 AC	240 DC
105	Century b.b.	220/440 AC	70 DC
100	Whse.*	2300/4000 AC	275 DC
100	Al. Ch.	220/440 AC	125 DC
100	Delco b.b.	220/440 AC	125/250 DC
90	G. E.* (2)	220/440 AC	125 DC
75	Whse.	220/440 AC	250 DC
60	Gen. Elec.*	220/440 AC	60 DC
50	Whse.	220/440 AC	250 DC
50	Gen. Elec.	220/440 AC	125 DC
50	Allis. Ch.	220/440 AC	125/250 DC
45	Gen. Elec.*	220/440 AC	60 DC
30	Otis (5)	220/440 AC	250 DC
25	Whse.	220/440 AC	125 DC
25	Gen. Elec.	220/440 AC	250 DC
20	Whse.	220/440 AC	600 DC
17	Gen. Elec.	220/440 AC	125 DC

*Synch. motor.

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New WAGNER MOTOR-GRAM lists hundreds of bargains in new and rebuilt Electric Motors and Generators. Write today!

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JULY SPECIAL

STEEL MILL DRIVE ELECTRICAL EQUIPMENT

We own and offer, in original crates, the following G.E. NEW steel mill equipment:

422 mill motor W/blower and fan
422 mill motor W/blower and fan

1—250 HP, 410/820 RPM, 230 v., MDP-420 motor W/blower and fan

3-unit synchronous motor generator set—suitable for 60 cycle

1—1250 KW, 750 RPM, 600 v., shunt wound DC gen. 40°C rise

1—750 KW, 750 RPM, 250 v., shunt wound DC gen. 40°C rise

1—3000 HP, 750 RPM, 6000 v., 3 ph., 50 cy., .8 PF, 40°C rise

3-unit synchronous motor generator set—suitable for 60 cycle

1—400 KW, 750 RPM, 250 v., shunt wound DC gen. 40°C rise

1—750 KW, 750 RPM, 250 v., shunt wound DC gen. 40°C rise

1—1750 HP, 750 RPM, 6000 v., 3 ph., 50 cy., .8 PF, 40°C rise

Control equipment for the above is available. Your inspection is invited.

Inventory is too large to list.

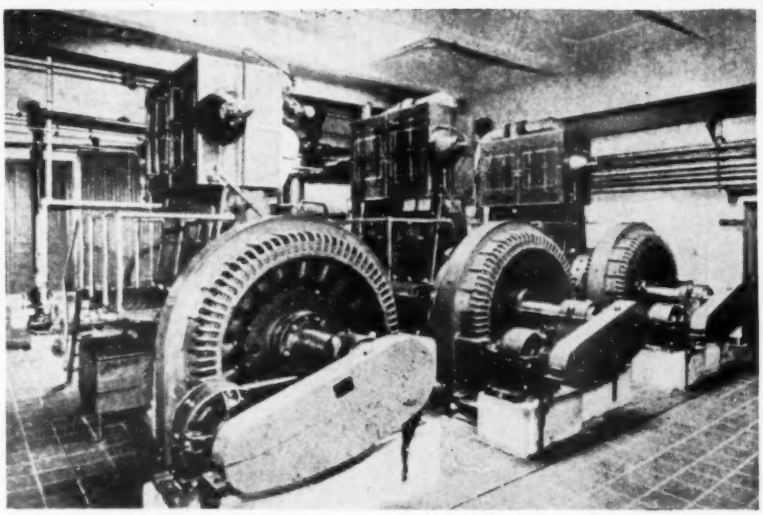
Send us your inquiries.

Phone or Wire Collect

ELECTRIC EQUIPMENT CO.

ROCHESTER 1, N. Y.

Phone LD 65



JULY SPECIAL

3—250KVA Ames Vertical Non-condensing Uniflow engine driven generators per photo, 3 phase, 60 cycle, 240 volt, 400 rpm, 140 psi, 5# back pressure—includes all accessories. Condition excellent. Inspection Engine Room — Claridge Hotel Atlantic City, N. J. Priced right for quick sale. Space needed. Contact us for inspection appointment.

MOTOR GENERATOR SETS

1500 KW G.E. 250 Volt 3/60/2300/360 RPM
1—1000 KW West. 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Mtr. .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels
1—500 KW Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 3/60/2300 V. A.C. & D.C. Panels.
1—300 KW West. 3 wire 125/250 Volt 1200 RPM Generator (1938 year). Can furnish with suitable motor. Advise Requirement.
200 KW Elliott 250 Volt 1200 RPM 3/60/ Any Voltage.
2—150 KW G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels
100 KW Electro Dynamic 200 V. 3/60/220/1200 B. Brg. Sq. Cg. Sep. Excited.
1—100 KW Al. Ch. 250 V. 1200 RPM 150 H.P. Syn. Mtr. 2/60 or 3/60 any voltage.
1—100 KW G.E.—C.D.—125 Volt D.C. 150 HP GE Syn. Mtr., 3/60/220/440/1200 RPM.
1—75 KW Burke 250 V. 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 ph. any voltage.
2—50 KW GE 500 Volt DC, 75 HP, 3/60/40/1200 RPM.
Smaller Sizes and Types—Advise Requirements

1—New O'Brien "Red-Line" 750 KVA OISC Transformer 13,200/13,800 v. pri., 480 v., sec., 3 ph.
3—333 KVA New O'Brien Red Line O.I.S.C. Transformers 4160 V primary 480 V secondary ea. single phase 60 cyc.

OISC TRANSFORMERS

Qu.	KVA	Make	Pri. V.	Sec. V.	Phase
3	2000	Al Ch.	33000	2300	1
4	2000	West. (Sub-sta)	23000	2400 (NEW)	1
3	1000	GE	13200	2300	1
1	1100	West.	4160	440	3
3	667	Al. Ch.	33000	2300	1
3	500	West. (Dry)	33000	2300	1
3	500	West.	22000	460	1
1	500	Gregory	4160	440	3
3	500	GE	13200	2300	1
3	400	GE	2400	480	1
3	333	Pitts.	33000	2300	1
3	333	G.E.	13800	240/480	1
3	333	(New)	2400	480	1

OISC TRANSFORMERS (Con't)

3	333	GE	13200	2300	1
3	200	GE	7200	120/240	1
3	200	GE	13200	2300	1
3	200	Mal.	2300	220/440	1
3	150	Niag.	2400	240/480	1
3	100	GE	7200	120/240	1
2	100	GE	2300	115/230	1
3	75	Mal.	2300	115/230	1
3	50	West.	2400	240/480	1

DIESEL GENERATOR SETS

1—1250 KVA Nordberg 3/60/2300/360 RPM 1940
1—375 KVA GM 8-268A, 3/60/480/1200 RPM
1—250 KVA G.M. Twin 6-71, 3/60/220/440/1200 RPM Rad. Cooled.
1—187 KVA G.M. Twin 6-71 Portable, 3/60/220/440 New
1—125 KVA Hercules. 3/60/220/440/1500 Hrs.
2—45 KVA Chry. New 6 Cyl. 3/60/220/440.
1—200 KW G.M. Twin 6-71, 240 D.C. Rad. Cooled Elec. Start.

ELECTRIC MOTORS

Qu.	HP	Make	Type	Volts	Speed
1	1000	G.E.	K	2300	1800
1	1000	West.	CW	2300	450
1	700	West.	CW	440	1800
1	600	West.	CS	2200	600
1	500	Al. Ch.	Syn.	2300	212
1	500	AC	ARX	2300	1800
1	500	West.	CS	6600/2300	514
1	450	A.C.	ANY	2300	600
2	400	G.E.	IK	2300	1800
1	400	West.	CW	440	514
1	400	G.E.	Syn.	2300	450
1	350	G.E.	MT18	2300	400
1	250	G.E.	IM	2300	450
2	200	G.E.	KT559	2200	1200
1	200	West.	CW	440	1800
1	200	G.E.	IM	440	600
1	125	West.	Syn. 3.brg.	550	600
2	100	G.E.	KT352	220/440	1200
1	100	G.E.	KT543	440	1800
1	50	West.	CS	440	3600
1	50	West.	CS	440	1200

EXCEPTIONAL DELIVERY
New O'Brien mfrd. Red Line dry type Transformers to 150 KVA single phase, 300 KVA, 3 phase—4800 V. Pri.—& Phase Changers to 100 KVA.

TURBO GENERATORS
Philadelphia Stock

1—1250 KVA DeLaval Non-Cond. 3/60/2300. New 1940 240 psi 50 lb. B.P.
1—780 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Cond. 180 PSI 35 lb. B.P. New 1936.
1—500 KVA West. Non-Cond. 3/60/220/440, 150 PSI 10 lb. B.P.
1—200 KVA Moore Non-Condensing 3/60/480, 195 PSI, 100° F, 100# BP. Year 1936.
1—187 KVA West. Non-Cond. New 1930 3/60/440 110 psi 10 lb. B.P.
1—94 KVA Worthington Non-Cond. 3/60/220 140 psi 5 lb. B.P.
1—75 KW G.E. Non-Cond. D.C. 125 volt.

PLATING, ANODIZING SETS

5000/2500 amp, 6/12 v. Hansen V.W.M.
5000/2500 amp, 12/24 v. H.VW.M.
3000/1500 amp, 6/12 v. Elec.Prod.
2500 amp 6 v. H-VW-M.
2000/1000 amp 6/12 v. Elec.Prod.
1500/ 750 amp 6/12 v. Elec.Prod.
1250 amp, 15V. Columbia
All above synchronous motor drive.

AIR COMPRESSORS

1—12,000 CFM I.R. Turbo 3.25 lb., direct 250 H.P., 440/3/60/3600.
1—5600 CFM I.R., PRE-2, 42/25½x30, 100 lb. direct 930 HP Syn. 1 P.F. 2300/60/3.
1—4690 CFM I.R. PRE-2, 48/24x27 100 lb. direct 804 HP Syn. .8 PF 2300/60/3.
1—1600 CFM Sullivan WJ 8 Angle Cpd. 100 psi 22/13x16 belt.
1—978 CFM Sullivan 13x13x8, 45 psi.
1—900 CFM CP 100 lb. 9CP Portable Diesel Compressor, Pneu. tires.
1—528 CFM Ing. Rand 14x12, 100 psi.
1—215 CFM Penna 3A, 70 psi—V-Belt
1—368 CFM Chi. NSB, 12x10, 100 psi.
1—371 CFM Schramm 7½x5x4, 100 psi

BOILERS

4—500 HP Cleaver Brooks Package 200 lb.
1—300 HP Cleaver Brooks Package 160 lb.
1—450 HP Keeler CP 160 lb. Oil
1—300 HP Keeler CP 300 lb. Oil
1—150 HP Union Univ. Stoker 150 lb.
1— 60 HP Ames Package 125 lb.

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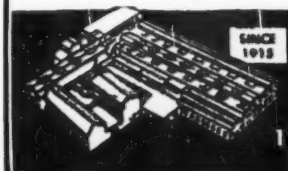

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AFFILIATED WITH SOC EXPANSO INDUSTRIAL SOL AMERICANA LTDA RIO DE JANEIRO—BRASIL

THE TRADE MARK WITH A MEANING
SUCCESSFUL OPERATION GUARANTEED
*45th Year of Service—Member of A.R.A.**

A. C. MOTORS
3 ph. 60 Cycle

SYNCHRONOUS

Qu.	HP	Make	Type	Volts	Speed
1	5000	Whse.		2500/5000	600
1	4350	Cr. Wh.		4160/13800	514
2	3500	G. E.	TS	2300	257
1	2500	G. E.	ATI	2300	720
2	2100	G. E.	ATI	2300	360
2	2000	Whse.		2300	120
1	2000	G. E.	ATI	2200	900
2	1750	G. E.	ATI	2300	3600
3	735	G. E.	ATI	2200/12000	600
1	500	Ideal	SM	2300/4150	1800
1	450	Whse.	Eng.	2200	128.5
1	450	Whse.		2300	450
2	350	G. E.	TS	2200	150
1	300	Whse.		2300	720
1	150	Whse.		440	600

SLIP RING

1	1500	G. E.	MT-498	2300	360
1	1500	ABB		2300	720
1	1200	G. E.	MF-26	2300	275
2	1000	A. C.	Mill	2300	240
1	500	Whse.	CW	550	360
1	500	G. E.	IM	2300	900
1	500	G. E.	IM	440	900
1	400	Whse.	CW-1218	2200	435
1	400	Whse.	CW	440	514
1	350	G. E.	MT-442Y	2300/4000	253
2	300	G. E.	MT-565Y	2300	900
1	250	G. E.	IM-1713	2300	450
1	250	G. E.	MT-424Y	4000	250
1	250	G. E.	MT-559S	2200	1750
1	250	A. C.		550	600
1	200	Cr. Wh.	26QB	440	505
1	200	G. E.	IM	440	435
1	200	G. E.	MTP	440	1170
1	200	Whse.	CW	440	490
1	150new	Whse.	CW	2300	450
1	150	G. E.	IM-16	440	600
2	125	A. C.		440	865
1	125	A. C.		440	720
4	125	G. E.	MT-566Y	440/2200	435
2	100	G. E.	IM	440	600
1	100	G. E.	IM	2200	435
1	100	A. C.		440	695
4	100	G. E.	MT	440/2200	435

SQUIRREL CAGE

2	650	G. E.	FT559BY	440	3750
2	450	Whse.	CS	2300/4150	354
1	200	G. E.	IK-17	440	580
3	200	G. E.	KT-557	440	1800
1	200	G. E.	IK	440	865
1	75/150	G. E.	IK	440	450/900
1	150	Whse.	CS	440	580
1	150	Wstghse.	CS8568	440	830
1	125	Whse.	MS	440	485
2	125	At. Ch.	ARW	2200	1750
1	100	G. E.	IK	440	580
1	100	G. E.	IK-Vert.	2200	450

D.C. MOTORS

Qu.	H.P.	Make	Type	Volts	Speed
1	2200	G. E.	MCF	600	360/500
1	2000	Whse.	Mill	600	230/460
1	940	Whse.	QM R Brg.	250	140/170
1	900	Whse.		250	450/550
1	825	Whse.	Mill	250	90/160
1	600	A. Ch.	MILL	230	400/800
1	500	Whse.	Mill	600	300/900
2	450	Whse.		550	415
1	400	G. E.	MCF	550	300/1050
1	300/400	G. E.	DYNA	250	1325/2500
2	300	Whse.	CB-5094	230	575/1150
1	200/300	G. E.	MPC	230	360/920
1	250	G. E.	MPC	230	400/500
1	200	Rel.	1970T	230	720
1	200	Whse.	CB-5113	230	400/800
1	150	G. E.		600	250/750
8	150	Cr. Wh.	83H	230	890
1	150	Cr. Wh.	CMC-65H	230	1150
1	150	Whse.	SK-201	230	360/950
1	150	Whse.	SK-151 B	230	900/1800
1	150	Whse.	CB-2073	230	525/1150
1	125	G. E.	MDS-416	230	415
1	50/120	G. E.	MFC	230	250/1000
2	100	Whse.	SK-181	230	450/1000
1	60	El. Dy.	25-S	230	525/1050
2	50/60	Whse.	SK-170	230	400/1200
1	50	G. E.	CO-1810	230	725
1	50	Whse.	SK-170	230	350/1050
2	50	G. E.	RCF-31B	230	1700

MOTOR GENERATOR SET
3 ph. 60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G. E.	514	600	13800/4000
2	2000*	G. E.	500	600	6600/11000
3	1500	G. E.	514	250	4000/13200
1	1500	G. E.	720	600	6600/13200
1	1500	G. E.	360	275	2300/4400
1	1500	G. E.	600	600	2300/4150
1	1500	C. W.	514	115	4160/13800
1	1200	A. C.	720	550	2300
2	1000	Whse.	900	600	2300/4100
1	1000	G. E.	900	260	6600
1	1000(3U)	G. E.	900	250	2400/4800
2	750	Whse.	900	275	2300/4160
1	750	C. W.	514	115	2300
1	600	G. E.	720	250	440/2300
1	500	Whse.	900	125/250	440
1	500	Whse.	1200	125/250	2300
1	500	G. E.	720	125	2300/4000
1	400	G. E.	720	250	440/2300
1	150	G. E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G. E.	1175	125	440
1	140(3U)	Cr. Wh.	690	125/250	2300
1	125	G. E.	1200	125	440
1	100	Delco	1200	125/250	440
1	100	G. E.	1200	250	2300/4000
2	35	Whse.	1750	125/250	2200

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1	12500	Whse.	60/25	13200x13200
1	3000	G. E.	25/60	4000/2300x2300/4000
1	2500	G. E.	25/60	2400x4150
1	2000	G. E.	25/62½	2300/4160
1	2000	Whse.	25/62½	2300/2300
1	1000	G. E.	25/58	4400/2300
1	500	A. C.	25/60	11000/2300V

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	1000	Moore	Auto-Ext. Cond. 175/200#I.S.P 5/20# G. Ext. Surface Condenser—3/60/2300.
	1000	G. E.	Non-condensing 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.
	750	G. E.	Condensing 425#-725#TT I.S.P. 440 V. 3 ph. 60 cy. New—1944
	750	Whse.	Non-condensing 135# I.S.P. 40# B.P. 750 Kw. 280 V. D.C.
	500	Moore	Non-condensing — 150/200 lbs. ISP 5/35 lbs. G.B.P.—3/60/480 volts direct connected exciter.
	500	G. E.	Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60.
	400	Whse.	Non-condensing 125/150# I.S.P. 5/10# G.B.P., 240/480v. 3 ph. 60 cy.
	300	G.E.	Non-condensing 10/175# I.S.P. 5/15# B.P. 480V. 3 ph. 60 cy.
	200	Whse.	Non, condensing 150# I.S.P. 7# B.P. 240 V. 3 ph. 60 cy.

TRANSFORMERS
60 Cycles

Qu.	KVA	Make	Type	Ph	Voltages
1	5000	Whse.	OISC	3	33000x26400/13200
1	3500	G. E.	WCT	3	13800/6900x2300/440
1	2500	Whse.	OISC	3	26400/13200x460
3	2000	G. E.	HVDDJ	1	66000x13800
2	1750	G. E.	WCT	3	13800/6900x2300/440
3	1000	G. E.	H	1	2200x480
1	1500	G. E.	HT	3	13200x2300
3	1250	G. E.	H	1	6600x550
1	1150	A. C.	OISC	3	13200x2300/480
2	1000	Pitts.	OISC	3	2300x460
4	1000	Al. Ch.	OISC	1	2300/4000x460
3	1000	Wagner	OISC	1	13200x220/440
2	300	Kuhl	OISC	3	13800x460
3	200	Whse.	O15C	1	13200x120/240
3	150	Whse.	OISC	1	33000x2300/4000
2	75	Upte	OISC	3	4160x240
1	50	Mol.	Askerel	3	13200x120/208

*American Rebuilders Association — Member Body of A.S.A.

BELYEA COMPANY, INC.
OFFICE AND SHOP

43 HOWELL ST., JERSEY CITY 6, N. J.

PHONE JO 2-3334—N. Y. CITY LINE RE 2-7150

LAND'S 44th YEAR
MOTORS & GENERATORS, etc.
1 YEAR GUARANTEE

GENERATORS—250 V. D. C. Motor Driven

KW	Make	Type	Speed
2000	G. E.	New	900
1150	G. E.	New	900
1000	Al. Ch.		720
250	Cr. Wh.	CCD	1200
150	West.	SK	900
125	G. E. (3)	MPC	1200
125	El. Dy.	20L	1750
100	Delco (4)		1150
75	West.	SK	900
75	Cr. Wh.	51H	1150
50	Cr. Wh.	HH	1150
40	West.	SK	1750
35	Al. Ch. (4)	3 wire	1750
25	G. E.	CS	1200
17	G. E.	RC	1750
15	Star		1750
7½	West.	SK-43	1750
5	West.	SK-284	1750
5	Rel.	T-23T	1750
3	Rel.	T-14T	1740

GENERATORS—Low Voltage D.C.

Amp.	Make	Voltag
10,000/5000	H-V-W	6/1e
3000/1500	Chandey.	12/22
2500/1250	Chandey.	6/14
2000/1000	H-V-W	6/12
750	H-V-W	6/12
4000/2000	North.	7½/12
3000/1500	Chandey.	8/15
10,000	J-L	16
1000	G. E.	10
6000/3000	El. Prod.	18/35
1000	G. E.	26
1000	West.	25
100	Diehl	34
200	West.	32
200	Burke	35
125	Diehl	45
500	G. E.	30
1500	Century	42
3200	G. E.	55
325	West.	50
1000	G. E.	70
		8

230 V. D.C. MOTORS

H.P.	Make	Type	Speed
350	G. E. (2)	MDP 422	375/750
250	G. E.	MDP 420	410/820
250/200	Rel.	2600T	400/800
150	West.	SK	1150
150	West.	SK	850
125	Rel.	T	600
125/50	E. D.	20-SL	1750/1315
100	West. (4)	SK	1150
100	West. (6)	SK	850
100	Rel.	651-T	850
100	G. E.	RC	600
100	Rel.	1060T	500
100	A-C		1150
100	FM	TRC-38	725
90/45	G. E. (2)	RF-17	950/475
75	G. E.	CD-155	1150
75	West. (6)	SK	1150
75	G. E.	RC	1000
75	Rel.	461-T	850
75	West. (2)	SK	850
75	West.	SK	475
75	Cr. Wh.	CMC-125H	375/950
60	West.	SK	850
60	West.	SK-160	680
60	West.	SK	250/1000
50	Cr. Wh.	CMC-FH	1750
50	West.	SK-160	565
50	G. E.	RF-17	250/1000
40	G. E. (3)	CD-105	850
40	Cr. Wh.	FH	1750
40	West. (5)	SK	775
35	E-D	258	350/1050
35	West.	SK	250/1050
35	West.	SK	1150

SLIPRING MOTORS

H.P.	Make	Type	Speed
600	Cr. Wh.	131-AQ	507
500	G. E.	IM	600
500	G. E. (2)	IM	450
250	G. E.	1M	600
200	G. E.	MT-557Y	1750
150	G. E.	IM	870
125	West.	CW	1750
125	G. E.	IM	580
100	G. E.	MT347	1150
100	G. E.	IM	690

SQUIRREL CAGE MOTORS

H.P.	Make	Type	Speed
250	GE(TENV)	K-6335	1750
200	Wagner	RP2-26Z	1800
200	West.		1760
200	A. Ch.	AR	885
200	G. E.	KF-6335	880
150	West.	CS	1178
150	G. E.	IK	580
125	A. Ch. (2)	53R	3500
125	A. Ch. (5)	AR	1890
125	Century		3500
125	A. Ch.		690
100	West.	CS6078	3540
100	West.	CS	870

Partial Listing Only!

Please Send Us Your Inquiries

L. J. LAND, INC.
Established 1910

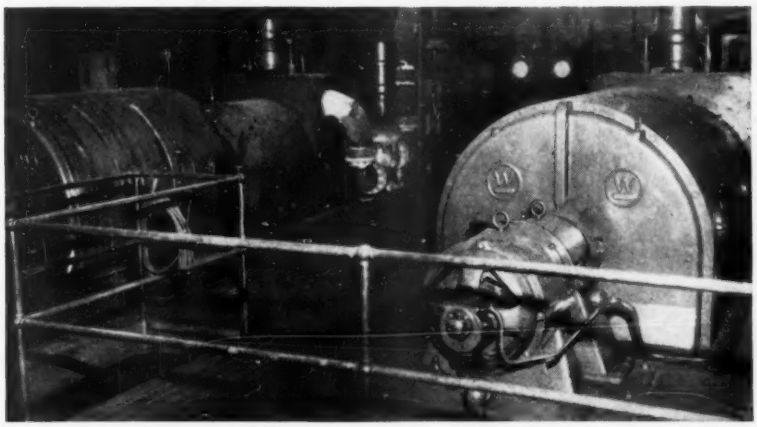
156 Grand Street, New York 13, N. Y.

CAnal 6-6976

Same as New. Modern. Non-condensing.

2500 KVA TURBO-GENERATOR

With Changes—A 400# PSIG., 700°F. TT., 50# BP., Turbine.
Very Complete INSPECTION REPORT in our files. Yours on Request.
Our Own Property. *Can Deliver IMMEDIATELY.*



Above Cut Was Made From Photograph Taken on Foundation of Our 2500-KVA., Westinghouse Non-condensing Turbo-Generator: A Very High Grade Modern (1935) Machine. Complete Unit With Direct Connected Exciter, Switchboard, Etc. DELIVERY, IMMEDIATE.

WATER RATE:	KW. Load	1000	1500	2000	2500
	Lbs. KWHr.	27.1	25.85	26.0	26.2

BELOW IS A PARTIAL LIST OF OUR STOCK

TURBO-GENERATORS ALL 3600-RPM.

CONDENSING

No.			
1	500-KW.	A.-C.	150/200 psig. 480-V
2	500-KW.	G.-E.	150/200 psig. 480-V
3	625-KW.	G.-E.	160/200 psig. 480-V
4	750-KW.	A.-C.	150/200 psig. 480-V
5	750-KW.	West.	140/200 psig. 2300-V
6	750-KW.	A.-C.	150/200 psig. 2300-V
7	750-KW.	G.-E.	150/200 psig. 480-V
8	1000-KW.	G.-E.	175/250 psig. 2300-V
9	1000-KW.	A.-C.	125/200 psig. 2300-V
10	1500-KW.	A.-C.	150/200 psig. 2300-V
11	1200-KW.	G.-E.	175/200 psig. 2300-V
12	2000-KW.	G.-E.	150/200 psig. 2300-V
13	2500-KW.	G.-E.	150/250 psig. 2300-V
14	3000-KW.	G.-E.	150/250 psig. 480-V
15	4000-KW.	West., A. Ext.	275/400# 600-V
16	5000-KW.	G.-E.	150/200# 2300-V
17	5000-KW.	West.	250/400# 480-V.

NON-CONDENSING

No.				
1	500-KW.	A.-C.	125#:10/15 BP.	480-V
2	500-KW.	G.-E.	175#10/15 BP.	480-V
3	500-KW.	West.	250/400:125# BP.	2300-V
4	750-KW.	G.-E.	125#:10# BP.	480-V
5	1000-KW.	G.-E.	125#:15 BP.	480-V
6	1250-KW.	G.-E.	200/250 psig. 20# BP.	480-V
7	2000-KW.	West.	250/350#:35# BP.	2300-V
8	2500-KW.	G.-E.	150/175#:15# BP.	2300-V
9	3000-KW	A.-C.	425#750F:60# BP.	13200-V
10	4000-KW	G.-E.	425#, 75° FSH. 60# BP.	13200-V

BOILERS, ETC.

B&W., 600#, 100,000# Steam per hr.
2—Springfield 511-HP., 250# 1935
1—Springfield 900-HP., 400# 1932
2—B&W 604-HP., Cond. A-1

Please Send Us Your Specifications for Diesel Engines, Boilers, Pumps, Etc.
Our New Stock List Is Just Off the Press. Send for It.

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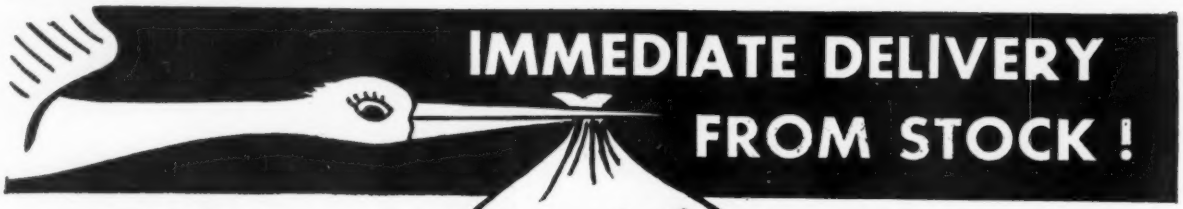

SQUIRREL CAGE, OPEN 3 PHASE MOTORS

HP	RPM	VOLTS	DESCRIPTION
750	900	6600	Westinghouse
550	3600	2200	Westinghouse
300	1200	2300/440	Westgh., CS
300	900	440	G.E.
200	490	2200	G.E.,-I
125	3600	220/440	A-C
125	1800	2200	A-C
115	1200	440	G.E.
100	1800	2200	Westinghouse
100*	1200	2200	G.E.-KF544
100	1200	2300/440	A-C, AR.
100	720	440	Westgh. 3 Brg.
85	3600	2300	G.E.
60	3600	2200	G.E.
60	1800	2200	G.E.
50	3600	220/440	G.E.-404S
50	1800	220	Triumph
50	720	2200	Westinghouse
40	1800	220/440	West.-444
40	900	440	G.E.
40	720	440	G.E.
35	3600	220	G.E.-KT
35	600	440	G.E.

*New Motors

4 SPEED MOTORS AND CONTROL

Century, Model SCNM504Y901AV, 20 HP, 440 volt, 3 Phase, 60 Cycle, 1700/1120/870/560 RPM, Multi-speed, ball bearing. With plugging switch mounted on shaft; motors on adjustable hinge bases. Control —Allen Bradley, Magnetic.

SLIP RING MOTORS

HP	RPM	VOLTS	DESCRIPTION
400	514	440	West.-Cw
375	1800	2300	Al. Ch.
350*	514	440	G.E., TE, FC, BB
300	514	440	Al. Ch. 3 Brg.
250	600	2200	G.E.-117B
250	450	2200	C.-W.
250	450	2200	G.E.-I-17B
250	300	2200	Al. Ch.
200	1800	440	Al. Ch.
200	600	440	West.-CW
200	600	440	G.E.-IM
200	514	440	West.-CW
150	1800	2200	FM-HV
150	720	2200	Al. Ch.
150	600	220	Wagner
125	1750	2200	West., CW
120	900	550	Ideal
100	720	440	Al. Ch.
100	600	2200	G.E. MT-562
100	600	220	Wagner
100	400	440	West. Elec. (GE)

*New

Special

FREQUENCY CHANGER

2500 KW General Electric
2300 volt, 3 phase, 25 cycle,
4000 volt, 3 phase, 60 cycle,
300 RPM.

MOTOR GENERATOR SETS

D.C. OUTPUT KW	Voltage	Description	A.C. INPUT HP	RPM	Volts
1500	600	G.E., MCF	2100	720	13200
1200	325	Al. Ch.-G.E.	2000	720	2300
800	500	West., 3 unit	1200	1200	2300
600	250	Westgh.	1200	1200	2300
750	550	G.E.	1070	900	2300
750	500	Westgh.	1070	900	13200
750	250	Westgh.	1070	900	13200
600	250	Westgh. (2-300 KW Gen.)	1200	1200	2300
600	250	G.E.	900	900	2300
400	250	Westgh.-G.E.	600	1200	220/440
300	250	G.E.	450	1200	2300
200	125	G.E.,-Westgh.	300	720	2300
200	125	G.E. (25 cy.)	300	730	440
200	250	G.E.,-Westgh.	300	1200	440
100	250	Delco-Westgh.	150	1200	220
100	250	G.E.	150	1200	220/440
75	125	G.E.	115	1200	440
50	125	C-W	85	1800	440
47½	125	Al. Ch.	100	1200	2300
40	250	Westgh.-G.E.	60	1200	220/440
35	125	G.E.	50	1800	2200
22	125	Al. Ch.	33½	900	220
20	115	G.E.-Al. Ch.	30	900	220
15	250	Al. Ch.-L.A.	25	1800	220/440

PLATING AND ANODIZING SETS

D.C. OUTPUT AMPS	VOLTS	RPM	DESCR.	HP	A.C. VOLTS		A.C. END DESCR.
4000	2 to 8	425	Jantz & Leist				
2400	40/80	1200	Westgh.	290	440		WH Sync.
1500/750	6/12	1200	Munning Loeb	15	440		GE—1 Cage
1200	60	1160	Century	108	220/440		Century, SCN-584
1060	60	1200	Century	100	440		Century Cage type 122Q
1000	6	1200	Wagner	—	—		—
800	30	900	C-W	40	220		C-W
680	11	900	Westgh.	15	440		W.H. BB.
600	50	900	E-M	40	440		A-C
600	30	1200	W-E	30	440		GE
600	30	900	G.E.	25	440		GE
500	40	1200	G.E.	30	440		GE-KT
500	12	1200	Ideal	10	220		GE-KT
500	6		GE Rect.	—	440		—
416	12	1200	HVW	7½	440		GE-KT
400	40	1800	Hobart	25	220/440		Hobart
208	62	1800	G.E.	20	220/440		GE-KT

MEMBERS OF AMERICAN REBUILDERS ASSOCIATION, A MEMBER BODY OF AMERICAN STANDARDS ASSOCIATION

Glow Electric Company

927 HARRIET ST. CINCINNATI 3, OHIO PHONE MAIN 3024

NEW MOTORS! • STOCK SHIPMENT

ALL BALLBEARING

General Electric, Louis Allis, Reliance, Westinghouse.
NEMA FRAME

Discounts from 60% to 65% Off on items listed below.

TEFC & EXPLOSION-PROOF 3/60/220-440

Quan.	HP	Speed	Make	Frame
1	75	3600	G.E.	504
2	60**	3600	Rel.	445
1	60**	3600	G.E.	445
1	50**	3600	G.E.	444
2	40**	3600	Rel.	405
1	40**	3600	G.E.	405
1	30*	3600	L.A.	405
2	30**	3600	G.E.	404
4	20**	3600	L.A.	364
1	15*	1800	L.A.	326
1	15*	1800	L.A.	364
1	10*	3600	L.A.	284
5	10**	3600	L.A.	284
2	10*	1800	L.A.	324
5	5**	3600	L.A.	225
3	5*	1800	L.A.	254
1	5*	900	L.A.	324
1	2*	1800	L.A.	225
1	2*	1800	L.A.	224
1	2*	1800	L.A.	225
1	1½*	1200	L.A.	224
10	1*	3600	L.A.	167
1	½*	1800	G.E.	63A

1/60/115-230

5	3*	1800	L.A.	254
1	1½*	1800	L.A.	225
6	1*	1800	L.A.	224

* I-D Label—** 2-G Label

OPEN DRIP-PROOF—3/60/220-440

Quan.	HP	Speed	Make	Frame
1	100	3600	G.E.	445S
13	40	3600	Rel.	404S
1	30	3600	G.E.	365
1	25	3600	G.E.	364S
2	15	3600	L.A.	324
1	10	3600	L.A.	284
1	10	1800	L.A.	324
1	7½	1800	L.A.	284
1	7½	1800	L.A.	284
7	7½	900	L.A.	326
1	5	3600	L.A.	254
2	5	1200	L.A.	284
2	5	900	L.A.	324
7	3	1800	Std.D.	225
4	3	1800	L.A.	225
2	3	1200	L.A.	254
1	2	1800	L.A.	224
10	2	1200	L.A.	225
1	1½	1800	L.A.	204
2	1½	1200	G.E.	224
2	1½	1200	L.A.	224
7	1	3600	Rel.	203

3/60/220 GEARMOTORS

3—5/3.3/2.3/1.66 HP, 55/36/27/18 RPM, Whse. Frame FD324. Parallel shaft output.

BRAKEMOTORS

22	¼	1735	L.A.	163

N/Size 5 C-H brakes

Many larger brake motors also in stock

10,000 OTHER MOTORS IN STOCK—FHP THRU 1000 HP, NEW AND REBUILT.

BENSON-WILIMZIG, INC.

1708 North 8th Street Garfield 4290 St. Louis 6, Missouri

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TRANSFORMERS

IMMEDIATE DELIVERY

2—G.E. AUTO-TRANSFORMERS

Type HT form SDHJ 60 cycle, 28,000/13,800 volt 3 phase 15000 K.V.A. continuous 55°C Rise. For outdoor installation.

4—G.E. INDUCTION REGULATORS

Type IRS.2-345-60 form FT-72, 345 K.V.A. Primary 13,800 volt. Secondary amperage 500.

6—WESTINGHOUSE TRANSFORMERS

Type SK Style SO 4B 998, 100 K.V.A. single phase 60 cycle 2750/1962/1892/1375/220/110.

TRUCK SWITCHES OIL CIRCUIT BREAKERS

From 2750 volt to 15000 volt, 200 to 600 amperes.

AIR COOLED TRANSFORMERS

50 K.V.A. to 2800 K.V.A.

15,600/7800 volt
13,200/3000 volt
3,500/3500 volt
2,750/110 volt

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65 Muirhead Ave. • Trenton 7, N. J.

Telephone 5-6349

CHICAGO Electric Digest

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GUARANTEED REBUILT EQUIPMENT AID TO INDUSTRY

M. G. SETS

KW	Make	AC	DC
2400	Westgh. (3-unit)	4800	525
1000	G. E. "	11000	137/275
1000	Westgh. "	11000	137/275
500	AC-Westgh.	2300	250
450	G. E. (3-unit)	2300	125/250
400	A. C.	2300	120/240
300	Cr-Wh.	440	250
200	G. E.	440	550
200	Westgh.	2300	275
200	G. E.	440	600
150	G. E.	2300/440	250
150	G. E.	2300/4000	125/250
150	G. E.	440	275
125	G. E.	440	300
125	Westgh.	440	250
100	G. E. (25 cy)	440	125
100	G. E.	2300	250
100	Ridgeway	2200	275
100	Westgh.	220	125
100	Elec. Machy.	220	125
90	G. E.	220	250
90	G. E.	440	60
75	Reliance	2300/440	250
60	A. C.	2300	110
50	G. E.	440	250
40	A. C.	220	125
35	Westgh.	2200	125
40	G. E.	220/440	250
25	Cr-Wh.	440	125
20	G. E.	440	250
20	Bogue-GE	550	250
20	Bogue-GE	220/440	125
	DC to AC		
100	G. E.	230	235
75	Westgh.	2300	110
12½	Westgh.	250	115

AC SYNCHRONOUS MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

HP	Make	Type	P.F.	Speed
1420	*Westgh.		.7	900
800	*G. E.		1.0	1800
710	*G. E.	ATI	1.0	720
700	*G. E.	TS975Z	1.0	1200
600	*G. E.	TS7640	1.0	900
600	*G. E.	TS	1.0	600
600	*G. E.	ATI	1.0	240
400	Westgh.	HG	1.0	900
300	G. E.	ATI	.8	1200
300	G. E.	ATI	.8	900
300	*G. E.	ATI	1.0	720
300	Ideal	SNS	1.0	257
250	*Cr-Wh.	251S4	1.0	1800
220	*Westgh.		1.0	600
190	Elec. Mach.	2S	1.0	720
175	*Westgh.	HR	1.0	360
150	*Westgh.	HR	1.0	300
125	*G. E.	ATI	1.0	900
125	*Elec. Mach.		1.0	900
125	*G. E.	TS	1.0	277
115	Elec. Mach.	EM	1.0	240
100	*G. E.	ATB	.8	900
100	Westgh.		1.0	900
100	Ideal	SNS	1.0	900
100	G. E.	TS6184	1.0	450
20	Fynn-W.	15VRN		1200
15	Ideal			1800
15	Century	ARC365	1.0	1200
7½	Ideal			1800

AC SYNCHRONOUS GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

KVA	Make	Type	P.F.	Speed
3500	*G. E.		.8	720
1750	*Westgh.		.7	900
1500	G. E.	ATI	.8	720
312	G. E.	ATI	.8	900
300	*G. E.	ATI	.8	720
225	G. E.	ATB	.8	600
187	Westgh.	ES	.8	720
100	*G. E.	ATB	.8	900
60	Fairb-Morse	B	.8	900
55	G. E.	ATB	.8	1200
50	G. E.	ATB	.8	1200
50	Westgh.		.8	1200
50	G. E.	ATB	.8	900

CRAFTSMANSHIP MEANS QUALITY

SLIP RING MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

HP	Make	Type	Speed
2000	*G. E.	MT-12	600
2000	*G. E.	MT-30	237
1500	*G. E.	MT-30	240
1250	*Westgh.	CW	600
1000	*Westgh.	CW	250
700	*A. C.	ANY	720
500	*G. E.	IM	3600
500	*G. E.	MTP	1800
500	*G. E.	MT	450
500	Westgh.	CW	350
400	A. C.	3-brg.	450
400	*G. E.	MT412	450
350	Westgh.	CW	900
300	*G. E.	IM13A	1800
300	*G. E.	MT410	450
250	Westgh.	HF15H	600
200	G. E.	IM15	1200
150	G. E.	MT549 BB	1800
150	Westgh.	CW772C	1200
125	*G. E.	MT549	1800
125	G. E.	IM15A	600
100	A. C.	ANY	900
100	G. E.	IM15A	450
75	Northwestern	HW50	1800
75	G. E.	MT347	1200
75	G. E.	MT356	900
75	G. E.	IM	720
75	G. E.	IM14	600
60	Westgh.	CW762C	900
50	G. E.	IM11A	1800
50	*A. C.	ARY	1800
50	Westgh.	CW636A	1200
50	G. E.	MT346	720
50	G. E.	IM14	450
40	*G. E.	MT532	1200
40	G. E.	MT336	1200
35	Fairb-Morse	UAB (vert)	1800
35	G. E.	IM	1200
30	G. E.	MT532	900

D. C. MOTORS

Mill Type—Pedestal Bearing—Reversing

HP	Make	Volts	Speed
1500	Westgh.	525	600
1200	Westgh.	525	600
1000	Westgh.	450	600

230 Volts—Constant Speed

HP	Make	Type	Speed
250	G. E. (550 v)	MPC4	700
200	Cr.Wh.	CM	500
175	G. E.	ELC	750
100	G. E.	RC34	2500
100	G. E.	RC19	575
100	Westgh.	MC90	460
50	G. E.	RC35	700
50	G. E.	DLC-204	650
40	G. E.	CO2004	600
35	Cr.-Wh.	CM351	700
30	Cr-Wh.	CCM	440
30	Sprague	C-60	240/300
25	Westgh.	SK100L	1100
25	G. E.	RC32	900
25	G. E.	RC32	800
25	A. C.	E130	775
25	Westgh.	SK133	575

MANY OTHERS—1 HP and up
ALSO VARIABLE SPEED AND 115 VOLT MOTORS

WE WILL BUY

YOUR SURPLUS MOTORS
GENERATORS • M.G. SETS
HOISTS • COMPRESSORS
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For over 42 years, Chicago Electric has been a leader in the rebuilding of electrical power equipment. This record of business is positive testimony to the exacting standards and high quality of the Chicago Electric rebuilding work. Equipment is rebuilt to perform "like new" and fully guaranteed. Whatever your needs be sure to check with Chicago Electric first.

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

HP	Make	Type	Speed
1750	*G. E.	K	3600
1000	*G. E.	K6347S	1800
750	*A. C.	TEFC	1800
750	*G. E.	KT	720
700	G. E.	FT	3600
500	*A. C.	6316SW	1800
400	*G. E.	KF559	3600
300	*Westgh.	CS	3600
250	*L. Allis	OGX148	720
250	G. E.	IK	600
200	*G. E.	FT549Y	3600
200	A. C.	ARWX	3600
200	*G. E.	IK13B	1800
200	A. C.	ARWWT	600
200	G. E.	IK17	600
200	*G. E.	K6325S	514
150	A. C.	AR DP	3600
150	*A. C.	AN	1800
150	G. E.	IE-K	1200
150	*G. E.	KT566 TEFC	720
150	G. E.	IK16	600
150	*Westgh.	CS 3-brg.	600
125	Westgh.	CS504S	3600
125	*A. C.	AR226	1800
125	*Reliance	AA6085 BB	900
125	Westgh.	CS856C	900
100	L. Allis	EX114S ExPr	3600
100	*G. E.	FT542Z	1800
100	*Westgh.	CS	1800
100	A. C.	AW	1200
100	G. E.	IK13A	1200
100	U. S.	CFU (vert)	1200
100	*Westgh.	CS (vert)	1200
100	*Westgh.	CS774C	900
100	G. E.	IK15A	514
75	Westgh.	CS445S	3600
75	G. E.	KT537	1800
75	G. E.	IK11A	1800
75	A. C.	AR505	1200
75	Howell	TEFC	1200
75	Fairb-Morse	HO BB	1200
75	G. E.	KF542 BB	1200
75	*A. C.	AR (vert)	900
75	A. C.		900
75	A. C.	AN	720
75	G. E.	IK	600
75	Fairb-Morse	H24B BB	514
60	G. E.	KF444Z	3600
60	*Westgh.	CS504S	1800
60	A. C.	APZ445S TEFC	1800
60	*Westgh.	CS505S TEFC	1800
60	A. C.	APZ504U TEFC	1200
60	Westgh.	CS752C	1200
60	A. C.	AR823	900

HUNDREDS OF SMALLER MOTORS!

TRANSFORMERS

KVA	Make	Phase	Pri.	Sec.
1000	Westgh.	3	4800	480
850	Westgh.	3	4160	455
667	G. E.	1	33000	480
500	American	1	2400	240/480
400	West. (air)	3	12900	213
300	G. E.	3	13800	240/480
300	G. E.	3	2400	240/480
250	G. E.	1	4160	240/480
200	Wagner	1	2400	575
167	A. C.	1	2400	120/240
100	Pittsburgh	1	2400	575
100	Pittsburgh	1	2400	240/480
100	American	1	2400	240/480
100	G.E.(Pyr'l)	1	2400	120/240
50	Westgh.	1	2400	120/240

NEW Dry-type Transformers to order —to 150 KVA Standard or Special—

MOTORS • GENERATORS • TRANSFORMERS

7 x 7 AIR COMPRESSOR

Ingersoll Rand 7x7 Class ERI—100#—with or without drive.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Meter—580 H. P. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. D.C. Direct connected to 50 HP 3/60/440/1800 Gen. Elect. Motor.

400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

55" LIFTING MAGNETS

2—55" Cutler Hammer Magnets 250 Volts DC. Excellent Condition.

1—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen. Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP G. E. Type KT 3/60/2300/1200 RPM.

150 HP G. E. Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP G. E. Type KT 3/60/440/600 RPM.

250 HP G. E. Type KT 3/60/440/720 RPM.

T.E.F.C. MOTORS

2—200 HP West. XP-3/60/2200/3600, Frame 8120H.

1—125 HP G.E., TEFCBB, Frame KF63282, 60/3/440/3600 RPM.

60 HP West. CS-607 3/60/440/900, X-Proof.

50 HP Ideal, New, 3/60/220/440/1800.

2—20 HP Louis Allis ES-365, 3/60/220/440/1800, X-Proof.

15 HP Louis Allis Ex-364, 3/60/220/440/1800, X-Proof.

125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

TRANSFORMERS

4—333 KVA Gen. Elect. Transformers Type H Form VRW Primary 2400/4800 Secondary 240/480 Single Phase 60 cycle with Taps. Immediate Shipment.

3—200 KVA Niagara—New. OISC. 1 Ph. 60 Cy. 2400/4160Y. 240/480.

1—75 KVA Niagara—New. OISC.—3 Ph. 60 Cy. 2400 V. Primary, 280Y/120 Secondary.

6—50 KVA. Niagara—New. Dry Type 1/60/-240/480—120/240.

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

AMERICAN 50 Years' Record Guarantees Satisfaction

- NEW AMERICAN AF—1 & 2 Stage Electric—Steam
- Rebuilts—Standard makes & sizes Stationary or Portable
- Rental—Gas—Diesel—Electric—Steam
- Rebuild or Convert your Compressor

PORTABLES

60 CFM Worthington (Gas) 2 PNEU
70 CFM Smith (Gas) 2 PNEU
105 CFM Worthington & Ingersoll
160 CFM Worthington (Gas) 2 & 4 PNEU
210 CFM Worthington (Gas & Diesel)
315 CFM IR & Worthington (Gas & Diesel)
500 CFM Worthington (Diesel) 4 PNEU
600 CFM Worthington (Diesel) 4 PNEU

STATIONARY

CFM	PSI	SIZE	MANUFACTURER
44	150	5x5	Ingersoll ER-1
66	110	6x5	Penn-IR
69	125	6x6	Ingersoll ER-1
88	60	7x5	IR-Penn
93	100	7x6	American-IR
122	100	7x7	Worthington-IR
130	125	8x8	American-IR
161	60	8x7	Ingersoll ES-1
166	135	8x9	IR-Worthington
187	40	10x6	Chicago NSB
211	100	9x9	Worthington HB
254	125	10x10	Chicago Pneu.
262	75	10x9	Worthington-HB
294	125	10x11	Ingersoll ES-1
311	40	12x8	CPT-Penn-IR
364	20	12x7	Worthington-IR
368	100	12x10	IR-CPT
379	40	12x9	Worthington HB
386	115	12x12	Ingersoll ER-1
426	130	12x11	Ingersoll ES-1
503	10	14x10	IR-Sullivan
528	100	14x12	CPT-IR
622	100	14½x13	American AF-1
740	40	17x10	CPT-IR
780	55	17x12	Ingersoll ER-1
868	125	17/10x12	Chicago Pneu.
1084	30	20x12	IR-CPT
1180	125	18/11x10	Chicago

America's No. 1 COMPRESSOR REBUILDER Since 1902

We have a unit for your requirements from our stock of over **300** compressors & vacuum pumps.

AMERICAN AIR COMPRESSOR CORP.
Dell Ave. & 47th St., North Bergen, N.J. · Union 5-4848

TRANSFORMERS FOR SALE

6—1000 KVA Mol. 11500—2400/4160Y
3— 500 KVA G-E 22000—2300/4000Y
2— 333 KVA G-E 13800—230/460
3— 333 KVA W-H 6600—2300
3— 200 KVA G-E 22000—2300
3— 200 KVA Mol 3450—2300
3— 150 KVA G-E 44000—600/2400
3— 150 KVA G-E 19050/33000Y—2540/4000Y
2— 150 KVA G-E 6900—230/460
3— 100 KVA G-E 33000—6900/11950Y
3— 100 KVA G-E 13200—2300
3— 50 KVA A-Ch 33000—6900/11950Y
3— 50 KVA A-Ch 33000—2400/4160Y
3— 50 KVA A-Ch 13200—2300/4600
1— 500 KVA W-H 27600—444/131 3-phase Rotary

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
CINCINNATI 27, OHIO
40 Years Dependable Service

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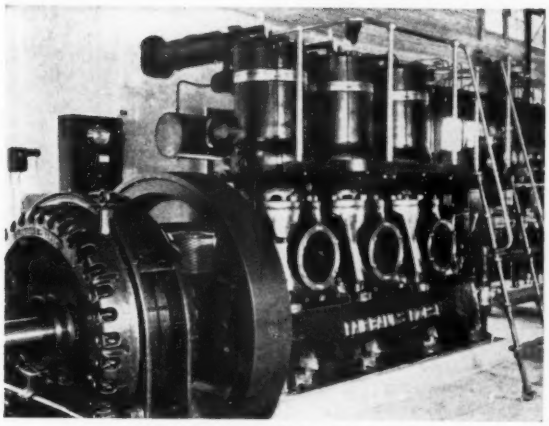
450 KVA—3-60-13200-115/230 V. substation.
1000 KVA—3-60-13800-240/480 V. substation.
700 & 450 HP—180 rpm—4160-3-60 UNUSED syn motors.
3—600 A.—15 kv GE metalclad Swgr. units.
3—500 KVA—3-60-13800-240/480 V. Transformers.
1—37½ KVA 240/480 V.—3-60 Caterpillar Diesel set.

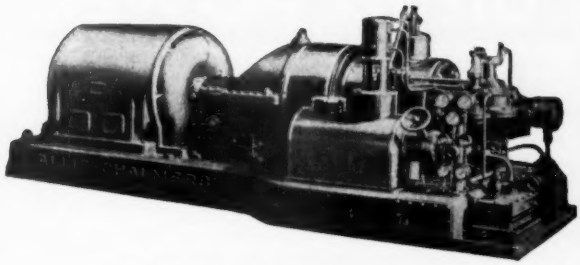
H. BLANE JOHNSON & ASSOCIATES
53 W. JACKSON BLVD., CHICAGO 4, ILL.

Special Bargain Offerings

TURBO GENERATORS
DIESEL GENERATORS
UNAFLOW UNITS



185 KVA FAIRBANKS MORSE
DIESEL GENERATOR — INSTALLED 1948



937 KVA ALLIS CHALMERS 480 VOLT
NON CON. UNIT

TURBINE GENERATOR UNITS

Condensing—3 phase, 60 cycle

30,000 KW G.E. 12,000 volts, 235# PSI
25,000 KVA G.E. 12000/13200 volts, 235 PSI.
6250 KVA G.E., 5-stage, 2300/4160 volts. 200# PSI, 600°TT.
6250 KVA Westghse., 480 volts, 400 PSI. 15# G. extract with condenser.
5000 KVA Westghse., 600 volts, 275 PSI. 25# G, extract with condenser.
4000 KVA Allis 2300 volts, 200 PSI.
3750 KVA Westghse. 2400/4150 volts, 350#
3750 KVA G.E. 2300/4000 volts, 200 PSI.
2500 KVA G.E., 2300/480 volts, 3600 RPM, generator **LESS TURBINE.**
1250 KVA Allis, 480 volts, 250 PSI, 25# G. automatic extraction.
1000 KVA G.E., 450 volts, 275-400 FSI, 750°TT geared unit.
940 KVA Westghse., 2300 volts, 180 PSI, mixed pressure automatic extraction.
940 KVA Elliott, 2300 volts, 3600 RPM generator **LESS TURBINE.**

Non-condensing—3 phase, 60 cycle

5000 KVA G.E., 13,800 volts, 600 PSI.
1563 KVA G.E. 480 volts, 200 PSI, to 20# ga. back.
1250 KVA (2) G.E., 2300/480 volts, 150 PSI, 10# gauge back.
937 KVA ALLIS 480 VOLTS. 150#, 10# gauge back, excellent condition (photograph above).
625 KVA G.E., 2300 volts, 150 PSI, 40# gauge back.
500 KVA Terry, 480 volts, 325 PSI, 110# gauge backpressure.
125 KVA Westghse., 2400/480 volt, 125-250#, 5# ga. back. Geared unit.

UNAFLOW GENERATOR UNITS

3 phase, 60 cycle

750 KVA Skinner 240 volts, 150 PSI, 8# back.
625 KVA Ames 2300 volts, 150 PSI, 5# back.
375 KVA (2) Skinner 2300/480 volts, 125 PSI, 8# back.
375 KVA Skinner 600 volts, 150 PSI, 10# back.
312 KVA Skinner, 240 volts, 125 PSI, 5# back.
250 KVA (2) Ames vertical 480 volts, 150 PSI, 5# back.
250 KVA (2) Skinner, 2300 volts, 150 PSI, 5# back.

SPECIALLY PRICED

- **9000 sq. ft. Condenser Engineering, 7000 sq. ft. and 5000 sq. ft. Wheeler surface condensers.**
- **12000 GPM, 25' hd. Worthington circulating pump direct connected to 200 HP, 3/60/2300 volt G. E. motor.**
- **6000 GPM Dayton-Dowd circulating pump, 70' hd. direct connected to 125 HP, 3/60/2200 volt G.E. motor.**
- **3500 GPM Allis dual drive circulating pump, 70' hd. direct connected to 75 HP, 3/60/440 volt Allis motor.**
- **5000 KVA Westghse. synchronous condenser 3 phase, 60 cycle, 4000 volts 720 RPM.**
- **150,000# per hr. B&W (2) cross drum water tube boiler 250# pres. 125°F superheat, Taylor Stoker.**
- **547 HP B&W Sterling water tube boiler 225# pres. built 1938.**

DIESEL GENERATOR UNITS

3 phase, 60 cycle

5000 KVA Busch Sulzer 6 units, complete plant, also available units of two.
1420 KVA Fairbanks-Morse 2400/4160 volts modern.
1250 KVA Nordberg, 2300 volts.
937 KVA General Motors 2400 volts.
900 KVA Worthington 2400 volts.
875 KVA DeLavergne 2400 volts.
625 KVA Worthington, 2400 volts.
450 KVA Fairbanks-Morse, 300 RPM, very Modern.
400 KVA (3) Alco, 440 volts.
375 KVA Fairbanks-Morse, 2300 volts, 300 RPM.
250 KVA (2) Buckeye, 220/440 volts.
250 KVA General Motors 450 volts, 1200 RPM new.
185 KVA Fairbanks-Morse, 2300/480 volts, 300 RPM, Model 32-E-14, installed 1948. Guaranteed. (photograph above).
125 KVA Cooper Bessemer, 2400 volts.
20 KW Hill, 125 volt, Direct Current.

DIRECT CURRENT UNITS

540 KW Westghse. non-condensing turbine 250 volts D.C. NEW, 200# PSI.
400 KW G.E., 3-wire, 250 volts, 360 RPM generator connected Skinner vertical engine 150 PSI—5# back.
300 KW Westghse. 3-wire, 250 volts 150/250# PSI noncond. turbine.
100 KW G.E. 120 volts condensing or non-condensing geared 200-275 PSI.
60 KW (6) Elliott 125 volts condensing or non-condensing 200-250 PSI.

UMC UTILITIES MACHINERY CORP.
1965 EAST 6th STREET • CLEVELAND 14, OHIO • CH. 1-8210

There's more than 40% to 60% SAVINGS on

SCHOONMAKER DEPENDABLE
DIESEL POWER

because:

Each Schoonmaker-sold Diesel Engine Unit is fully REMANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all REMANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

The Schoonmaker Plants and Warehouses located in Jersey City, N. J. and Sausalito (San Francisco), California give NATIONWIDE SERVICE from Coast to Coast with modern, efficient and reliable facilities.

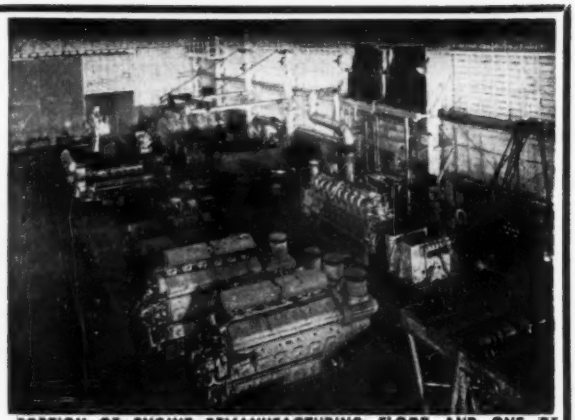
Our reputation and many years of experience and SPECIALIZATION in Diesel power equipment gives you value that money cannot buy elsewhere.

So—Buy SCHOONMAKER because you buy the FINEST in DEPENDABLE DIESEL POWER.

America's largest source of New and Remanufactured Diesel Power

A.G.
SCHOONMAKER CO., INC.

50 CHURCH ST., NEW YORK 7, N. Y.
PLANTS AND WAREHOUSES:
JERSEY CITY, N. J. AND SAUSALITO (S.F.), CALIFORNIA
TELEPHONE — DIGBY 9-4350 • TELETYPE — NY 1-2804
W. U. WIRE • CABLE — AGSCOMACH



PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1980	Nordberg	TS-217	3000	225
1136	Fairbanks Morse	38D	1600	720
1100	General Motors	16-278A	1600	720
1000	General Motors	16-567B	1440	720
750	General Motors	12-567	1080	720
500	General Motors	8-278A	750	720
500	Baldwin	VO-8	750	514
500	Alco	6-12½x13T	750	600
500	General Motors	8-567	720	720
400	Ingersoll-Rand	S-8	600	720
350	Baldwin	VO-6	510	450
320	Enterprise	DSG-6	460	450
300	General Motors	8-268A	450	1200
250	Fairbanks Morse	33-D	375	360
200	General Motors	8-268A	350	900
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
150	Worthington	CC-4	225	450
100	General Motors	3-268A	150	1200
100	Worthington	BB-5	150	600
100	Fairbanks Morse	38E	150	1200
60	General Motors	6-71	90	1200

ALTERNATING AND DIRECT CURRENT UNITS
STANDARD AND SPECIAL VOLTAGES AS REQUIRED

ONE YEAR **GUARANTEE!**

A FEW SPECIALS

BOILERS

Cleaver Brooks model OB25, 8600 lbs. steam, 200 lbs. pressure, Oil fired. "1949"

Combustion Engr. Premier #30, 250 HP semi-portable, steel encased, firetube, 150 lbs. pressure "1949"

1000 H.P. Combustion, 4 Drum, 200#
812 H.P. (2) Combustion, 3 Drum, 300#
400 H.P. BW 3 Drum, 160# "1949".
250 H.P. BW 3 Drum, 225# "1948".

TURBO UNITS, non-condensing

937 KVA GE 480/240 v.; O/15# bp
625 KVA Al.Chal.-Elliott 480/240 v.; O/15# bp
375 KVA Al.Chal.-Elliott 240/480 v.; O/25# bp
125 KVA GE 240/480 v.; O/30# bp

STEAM ENGINE UNITS (Uniflow)

375 KVA (2) Wghse.-Skinner, 3/60/600 v.
250 KVA Elliott, 240/480 v.
187 KVA Wghse.-Ames vertical, 240/480 v.
150 KVA GE-Skinner, 240/480 v.
75 KVA GE-Ames, 240/480 v.

DIESEL UNITS (Modern)

1138 KVA FM, opposed piston, 720 rpm
1000 KVA Elliot-De La Vergne 200 RPM
125 KVA (two) General Motors 1200 rpm
100 KVA General Motors 1200 rpm
50 KVA GE-Catapillar, 900 rpm
37 KVA General Motors, 1200 rpm

GAS ENGINE UNITS

250 KVA GE-Cooper Bessemer, 450 rpm, GS-6
750 KVA EM-Worthington, 360 rpm, DDG-8

POWER PLANT EQUIPMENT CO., INC.
39 Cortlandt St.
New York, N. Y.

Immediate Delivery in All Types of
BOILERS
Bought • Sold • Rented

ERIE CITY ECONOMICS

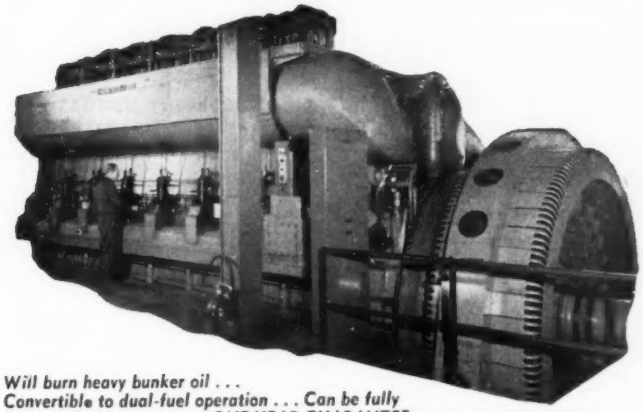
125 Lbs.—150 H.P.—1933-1938
150 Lbs.—125 H.P.—1947
Fire Box Type—165 H.P.—125 Lbs.—1941
Package Type—10-15-50-60-100 H.P.
Heating Boilers—5000-8000-12000 Ft.
8000 Gal. Cement Lined Hot Water Heater
Oil Burner—150 G.P.H. #6 Oil, Rotary, Equal New.

BOILER & EQUIPMENT CO.
743 Bedford Ave. Brooklyn 5, N. Y.
ULster 5-3588

CURRENT MODEL·· DIESEL

1980 KW NORDBERG MODEL TS-217 DIESEL UNIT

Heavy Duty • Slow Speed • Available Immediately



Will burn heavy bunker oil . . .
Convertible to dual-fuel operation . . . Can be fully inspected and test run . . . ONE YEAR GUARANTEE

ENGINE: (2800 BHP net) Nordberg, 7 cylinder, 2 cycle Diesel engine at 225 RPM, 21½" bore, 29" stroke, cylinders arranged vertical in line, solid injection.

GENERATOR: 1980 KW, 2475 KVA General Electric generator, 2400/4160/6900 volts, 3 phase, 60 cycle service at 225 RPM.

(50 cycle rating 1650 KW at 187 RPM)

UNIT AUXILIARIES AND ACCESSORIES

Complete standard engine auxiliaries and accessories including filters, strainers, pumps, gauge board, pyrometer, thermocouples, exhaust muffler, lubricating oil cooler, Young evaporative type cooler for jacket water cooling, thermostatic control valve, fuel oil day tank with transfer pump and oil meter, 2 lubricating oil storage tanks, lubricating oil transfer pump, Diesel-driven air starting unit, air tanks, air intake filter, special engine tools, all station piping, including flanges, adapters, valves, and fittings, for air intake exhaust, water, lubricating oil, fuel oil, and air. Generator and exciter control switchgear.

The unit above affords a rare opportunity to procure a complete, modern current model, heavy duty, slow speed diesel set at a great saving. It represents an offering which cannot be duplicated anywhere in the diesel market today.

Act now . . . Phone, Wire, or Write for Full Details

ALL OWNED AND OFFERED EXCLUSIVELY BY

TELEPHONE
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TELETYPE
NY 1-2804

A.G. SCHOONMAKER CO., INC.

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Western Union — WUX —
A. G. Schoonmaker Co.
Inc., N. Y.
CABLE:—AGSCOMACH

50 CHURCH ST., NEW YORK 7, N. Y.

Plants and Warehouses: Jersey City, N. J. and Sausalito (S.F.), California

LEA Offers You

M-G SETS—3 ph. 60 cy. Drive

1—750 KW G.E. 550V D.C. MPC., Syn. Dr.
1—500 KW G.E. 250V D.C. MPC., Syn. Dr.
7—400 KW West. SK. 125V. D.C.
2—200 KW West. SK. 250V. D.C.
2—150 KW West. SK. 250V. D.C.
1—150 KW G.E. 250V. MPC.
1—100 KW West. SK. 125V. D.C.
2— 75 KW West. SK. 125V. D.C.
95 other AC-DC Units

SQ. CAGE MOTORS 3 ph. 60 cy. 440 V

1—400 HP West. MS. 400 RPM

SQ. CAGE MOTORS

1—300 HP A.C. "AN" 1200 RPM
1—250 HP Ideal 600 RPM
1—150 HP A.C. T.E.P.C. 1300 RPM
1—150 HP G.E. I-K-17 450 RPM
500 Other Small Sizes

25 cy. 3/440 V SLIP RING MOTORS

1—800 HP, 1—600 HP
1—400 HP, G.E. 750 RPM
1—300 HP A.C. 500 RPM
1—225 HP G.E. I.T.C. 500 RPM
1—300 KVA Frequency Changer, G.E. ATI. 3 ph. 25 to 60 cy., or 60 to 25 cy. 440 to 440V.

Controls for the above can also be supplied . . . 4000 other units in stock. Write us.

LEA ELECTRICAL EQUIP. CO.
359 W. Chicago Ave. Chicago 10
Superior 7-0747

ELECTRICAL EQUIPMENT

REBUILT N.I.S.A. STANDARDS

AC Motors — 3 phase 60 cycle

HP	Speed Make	Wdg.	Type & Disc.
500(3)	1800 West.	Syn. 2200 V.	PedBrgW/Exc
450	1800 AC	SC 2200 V.	AW-SB
350	1800 AC	SC 2200 V.	AW-SB
200	1800 GE	SC	K6333S TEFC
150	1800 GE	SR	M-6328 TEFC
150	720 Allis-Chal.	SR	AR-Hoist
150	720 West.	SC	CS
125	3600 Elliott	SC 2200 V.	9N802
100	1800 GE	SR	IM
100	725 Allis-Chal.	SR (25 cy.)	AXY-3 Brg.
100	900 GE	Syn. 2200 V.	TS-DC Exciter
100(2)	1200 GE	SC	I-K
75	1200 Wagner	SC	24-W
75	900 West.	SR	CW-752C
75	900 AC	SC	AR-BB
75	600 GE	SR	IM
75	600 GE	SC 2200 V.	KT-558
60	1200 GE	SC	I-K
60(2)	3600 GE & W	SC	K&C8 4448B
60(3)	1200 Allis-Chal.	SR	ARY-505 BB
60	900 AC	SC 2200 V.	ARZ-TEFC
50	1800 GE	SC	IK
50	1800 FM	SR	HV-BB
50	1200 GE	SR	MT-336
50	900 GE	SC	IK
50	720 CW	SC	DC
50	600 CW	SR	ER
40	3600 GE	SC	K-405e Exp. Pr.
40	1800 GE	SC	KT
40(2)	1200 Rel.&West.	SC	Fr 445-BB
40(2)	1200 AC&Rel.	SC	TEFC-BB
40	900 West.	SR	CW
30(3)	1800 AC	SC	ARZ-TEFC
30	1200 AC	SC	ARZ-TEFC

SPECIALS

1—500 KVA Trans. West'hse Type ASL, 5% Imp. 13800/480 volts 75° Air Cooled. 2—150 KW West. M-G Sets 275 V. DC 3/60/2300 AC. 2—56RZ Falk Motoreducers 125 RPM 50 HP Class II. Hundreds other motors and electrical Items in stock. Large stock new motors to 150 hp & Gearheads to 30 hp at rated discount—Freight allowed. **SEND US YOUR INQUIRIES.**

NATIONAL ELECTRIC SERVICE CO.

735 So. 4th St., St. Louis 2, Mo. Phone — Chestnut 4603

MOTORS—M. G. SETS—TRANSFORMERS

ENGINEERED AND REBUILT BY EXPERTS IN OUR OWN PLANT

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	P.F.	Volts	R.P.M.
1	6000	G.E.	100	2300	90
1	3000	Whse.	80	4800/2400	720
3	2100	G.E.	100	2300	360
2	1750	G.E.	100	2300	3600
1	750	G.E.	80	2300	450
1	600	G.E.	100	440	360
1	700	G.E.	80	2300	720
1	250	G.E.	100	2300	514
1	200	Whse.	80	440	1200
1	187	G.E.	80	440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550	600
1	150	Whse.	80	220/440	450
2	135	G.E.	80	4000/2200	1200
3	125	El. Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440	1800
1	100	Ideal	80	440	900
2	100	G.E.	80	440	600

With these we can supply—Manual, Semi or full magnetic reduced or full voltage control.

SQUIRREL CAGE MOTORS

3-Phase — 60 Cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	400	Cont.	NZ-806	2300	1200
2	400	G.E.	I-K	2200	v514
1	400	G.E.	KT-412	2200	450
1	300	Whse.	CS-890	2300	1780
1	200	Whse.	CS-873-C	2200	1200
1	200	Al.Ch.	ARY	440	600
1	125	Al.Ch.	AR	2200	1750
1	125	Al.Ch.	AR	2300	514
2	125	C.W.	126-Q	440	430
1	100	Whse.	CS-663-C	440	1750
1	100	Al.Ch.	AR	550	720
1	100	Whse.	CS-938	2200	514
1	100	F.M.	H-241	440	450
2	75	Al.Ch.	AR	2200	1705
1	75	G.E.	I-K	440	600
1	75	Al.Ch.	AR	2200	720

Special—1 (new) G.E. Vertical KF-574, 2200-Volt 580 R.P.M., enclosed, hollow shaft

MOTOR GENERATOR SETS

Qu.	KW	Make	RPM	Volts DC	Volts AC
1 (3-U)	2400	Whse.	720	600	4800/2400
1	1500	G. E.	600	600	4160/2300
3	1000	Whse	514	600	11,000/6600
2	1000	G. E.	514	600	11,000/6600
1	750	Whse.	900	250	4160/2300
2	500	C. W.	720	575	2300/440
1 (3-U)	500	Whse.	1200	125/250	440
1	400	C. W.	1200	125/250	440
2	250	Whse.	1200	125/250	2300/440
1	200	Whse.	1200	275	4000/2300
1	200	Whse.	1200	125/250	4000/2300
1	155	G. E.	720	250	2300/440
2	150	Whse.	1200	125/250	440
1	100	Delco	1200	125/250	440/220
1	100	Ridgeway	1200	275	4000/2300
1	100	C. W.	1200	125	440/220
1	85	C. W.	1200	250	440/220
1	75	Al. Ch.	900	250	2300
1	75	Whse.	900	240	2300
1	25	Ideal	1750	125	440/220
1	25	Al. Ch.	1200	250	440/220
3	20	Al. Ch.	1200	250	440/220
2	15	Al. Ch.	1200	250	440/220

We can furnish any of these sets with D. C. panels, A.C. starting equipment, exciter sets and other accessories.

Motor Generator Sets of modern design, complete with control—still on their original foundations—available for immediate shipment.
(3)—G. E. 1500-KW, 250-VDC, 514 R.P.M., cpd., interpole, pole face windings, 2100-HP syn. motors, .8-PF, 13,200-V, 3-ø, 60-cy. will reconnect to 6600-V. or 4160-V.

TRANSFORMERS (Power)

Outdoor—Oil Cooled

Qu.	KVA	Make	Type	Phase	Voltage
3	250	Packard	A	1	13200-2200
3	150	Packard	A	1	2300-230/460

3—833-KVA Westinghouse O.I.S.C. transformers, type S, one phase, 60 cycle, still on original foundation, primary 66,000 Volts with (4) 2½% taps below secondary 2300/4160-Y. Can ship immediately from location.

SLIP RING MOTORS—CONSTANT DUTY

3-Phase — 60 cycle

Qu.	H.P.	Make	Type	Volts	R.P.M
1	1800	G.E.	MT 498	2300	357
1	1200	G.E	MT 26	2200	277
2	1000	Al.Ch.	ANY	2200	235
1	800	G.E.	MT	2200	440
1	600	G.E.	MT 20	2300	360
1	500	Al.Ch.	ANY	2200	514
2	500	G.E	I-16-M	2300	450
1	400	G.E.	MT 412	2200	440
1	250	Whse.	CW 937	440	1200
1	250	Al.Ch.	ANY	440	720
1	250	G.E.	MT 414	2200	300
1	125	Whse.	CW 870	2200	900
1	100	Whse	CW 766	440	1200
1	100	F.M.	H 20 C	440	900
2	100	G.E.	I-15A-M	2300	514

DIRECT CURRENT MOTORS

Qu.	H.P.	Make	Type	R.P.M.
1***	3600	Whse.	Encl. (Rev.)	600
1***	2400	Whse.	Encl. (Rev.)	600
4***	1500	Whse.	Encl. (Rev.)	600
4***	1200	Whse.	Encl. (Rev.)	600
4***	800	Whse.	Encl. (Rev.)	600
10**	700	Whse.	Mill	285/729
1	350	G. E.	CD-169	1150
1**	250	G. E.	MPC-6	325/975
1**	200/250	El. Dy.	Size 22	400/1200
1**	200	Whse.	Mill	300/1200
1**	200/250	G. E.	MPC	300/900
1**	180	G. E.	MPC	400
1***	125	Whse.	SK-190	600
1**	90/160	G. E.	MPC	625/1125
2	125	Whse.	SK-184	575/850
1	75	G. E.	CD-133	500/1000
1	60	El. Dy.	25-S	450/900
1	50	G. E.	RF-16	300/900
1	50	Whse.	SK	250/1000

All above are 230-VDC except where marked ***
***—Pedestal bearing mill type 525/600-VDC
**—Pedestal Bearing 230-VDC

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40, PENNA.

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

FOR IMMEDIATE DELIVERY

TURBO-GENERATORS—Condensing—500 to 20,000 KW; some extraction type, pressures 200 to 450#. *ON WHAT SIZE SHALL WE QUOTE?*
TURBO-GENERATORS—Non-condensing—300 to 3000 KW. 150# to 450#. some extraction with high back pressure. *WHAT SIZE INTERESTS YOU?*
STEAM GENERATORS—30000# to 100000# per hr. 150# to 450#.
BOILERS—Water Tube, Stirling & Straight Tube types 200 to 450#.
Special 2—500 & 1-770 H.P. B&W Co. Stirling Boilers 200#—excellent condition.
2—2000 H.P. B&W Sectional Header Boilers.
BOILERS—Fire Tube, 100 to 300 HP. 100 to 250#. *WHAT BOILERS?*

TRANSFORMERS Quick Delivery, Various Sizes Rebuilt like NEW—Guaranteed. Motor-Generators, Rotaries, Frequency Changers, Large Motors & Diesel Generators.

Send us your **INQUIRIES** *for* **ALL POWER MACHINERY**

CHARLES B. REARICK — 30 CHURCH ST. — NEW YORK 7, N. Y.

1000 KW DIESEL GENERATING SET

6 Cyl., Air Start, Bosch Inj. System, Nelseco Diesel Engine. 300 RPM, direct coupled to: General Electric AC, 1000 KW, 3/60/2300 volts, including: starting auxiliaries, switchboard, and spare parts.

Overhauled, ready to ship

VARIOUS OTHER MAKES & SIZES IN STOCK, AC & DC.

ALJON ELECTRIC DIESEL CO.
904-10 Pacific St. — Brooklyn 38, N. Y.
STerling 3-6515

POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS
1—20,000 KW, 200# 13,200 V.
1—10,000 KW 200# 13,800 V.
1—5,000 KW 275# 11,500 V.
1—4,000 KW 400# 2300 V.
1—3,000 KW 425# 13,200 V. Ext/170# Non Cond.
1—2,000 KW 175# 550 V. Cd.
1—1,500 KW 150# 2300 V. Cd.
1—1,500 KW 175# 550 V. Ext.
1—1,250 KW 250# 2400 V. Ext.
1—1,000 KW 200# 4160 V. N.C. NEW 1949.

2— 750 KW 150# 250 V. D.C.
1— 500 KW 200# 4160 V. N.C.
1— 300 KW 125# 250 V. D.C.
2— 120 KW 150# 240 V. N.C.

DIESEL GENERATORS
1—1000 KVA 2480 volts
3— 500 KW 480 volts
1— 400 KW 480 volts
1— 300 KW 2400 volts
2— 75 KW 240/480 V.

BOILERS
2—50,000# 275# (1949)
3—15,000# 275# (1945)
1—400 HP See. Hd. 225#
1—300 H.P. 300# (1948)
1—84" HRT 150# (1942)

WATER WHEEL GEN.
1—180 KW 20 F.H. 550 V.

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.
THE BUYERS MUST BE SATISFIED—ALWAYS

FOR SALE

1—24x30 Erie ball engine directly connected to Westinghouse 300 K.W. 250 Volt. 1200 Amp. 150 R.P.M. Interpole compound wound direct current generator.
1—Ideal 18"x19" Horizontal slide valve engine directly connected to 125 K.W. Triumph direct current generator 225-235 Volt. 532 Amp. 200 R.P.M.
1—Allis Chalmers Synchronous Converter, D.C. Volts No. Load 250 Full Load 250 Amp. 1200.
A.C. Volts 185 Amp. 600 Ph. 6 Cycles 60 R.P.M. 1200.
With transformer and switch panel.
ALSO Misc. sizes of 220 Volt D.C. motors starting boxes and switch.

THE NIVISON-WEISKOPF CO.
READING 15, OHIO

MOTOR GENERATORS
2—500 KW Westgh. 4160/2300—275 v—1200 rpm
1—150 KW G.E. 4000/23000 v—250 v—1200 rpm
2—150 KW Westgh. 2200 v—275 v—900 rpm

AIR COMPRESSORS
1884 ft. CHICAGO PNEU. OCE 2300 V
676 ft. WORTHINGTON 3/60/220/440 V

DARIEN, 60 E. 42nd Street, New York, N.Y.

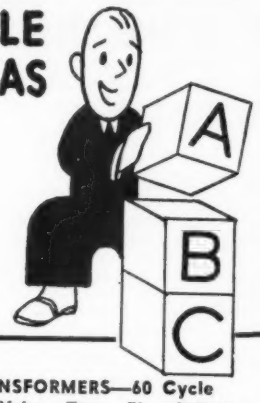
BOILER
1037 HP-700 lb. B & W
Type IF Spreader Stoker.
POWER EQUIPMENT
Complete Accessories and Auxiliaries
MERRILL and COMPANY
407 S. Dearborn St. — Chicago 5, Ill.
Telephone HArrison 7-8289

Mechanical Drive Steam Turbine

228 hp, 150#—0#—50#, Westinghouse C-25, 1920 rpm, Serial 1A9041-1.

Address: Sales Dept.
PENNSYLVANIA SALT MFG. CO. of Wash.
P.O. Box 1297, Tacoma 1, Wash.

SIMPLE AS



You get Guaranteed Electrical Equipment when you know its REBUILT & TESTED BY HEMPHILL ELECTRICAL ENGINEERS

JLHCo

This seal says so!

TRANSFORMERS—60 Cycle

Qu.	KVA	Make	Type	Ph	Voltages
1	1500	G.E.	Pyranol	3	4150x2400
1	1000	G.E.	Auto	3	4150x2400
2	750	G.E.	HT	3	4150x120/240
2	750	G.E.	H	1	4600-120/240
1	500	Kuhl.	OISC	1	4150x2400
2	400	Pitts.	OISC	1	4800/4150/2400 x240/480
3	333	Whse.	OISC	1	2400x575
1	333	G.E.	H	1	13200x220 440
2	300	G.E.	H	1	13200x440
4	200	G.E.	H	1	13200x440
2	200	A.C.	CBS	1	480x120/240
1	200	G.E.	HT	3	2400x240
2	150	Pitts.	ODSC	1	240x120/240
3	150	G.E.	H	1	2400x120/240
3	100	G.E.	H	3	13750x125/216Y
3	50	G.E.	H	1	4800x120/240
2	25	G.E.	H	1	575x115/230
	25	Niag.	OISC	1	2400x480
8	7½	Electran Air		1	460-8-40

MOTOR GENERATOR SETS

Qu.	KW	Make	Speed	DC	AC
1	1000	G.E.	514	600	2300/4150 Syn.
1	1000	Whse.	720	600	2300/4150 Syn.
1	1000	Whse.	720	275	2300/4150 Syn.
1	300	C.W.	1200	230	3-unit 2400/4150SR
1	300	G.E.	1200	230	2400/4150SR
1	200	Whse.	900	251	2300-4150 Syn.
1	150	C.W.	1200	230	440 SC
1	150	3 Unit G.E.	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	C.W.	1200	125	2300 S.C.
1	100	G.E.	900	250	2300 Syn.
3	60	G.E.	1200	125	208 Syn
2	30	G.E.	1200	125	440 SC

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	300	El. Mach.	720	TEFC	2200
3	200	Whse.	720		4150
1	175	G.E.	720	ATI	2300
1	150	G.E.	720	ATI	2300
1	150	G.E.	1800	TS	220
1	150	Whse.	900	181G	220

				Volts
1	150	A.C.	360	440
1	125	El. Mach.	900	4800
1	100	G.E.	900	2200

SLIP RING MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
2	500	G.E.	1200	M	2400/4150
1	400	Whse.	450	CW	550
1	250	Whse.	600	CW	440
1	200	Whse.	600	CW	440
1	200	G.E.	600	MT	440
3	150	A.C.	1800	AY RW	2300
1	100	G.E.	1800	IM	220
1	100	G.E.	600	IM	440
1	75	G.E.	600	IM	440
1	60	G.E.	1800	MT	220

DC, 230 VOLT MOTORS

Qu.	H.P.	Make	Speed	Type
1	300	G.E.	1200	MPC
2	150	C.W.	900	WP
1	125	G.E.	1700	RC
2	75	C.W.	900	WP
1	30	C.W.	700	CM
1	35	G.E.	860	RC
1	25	Whse.	825	SK

Member of The National Industrial Service Association, Inc.

FOR POWER

J.L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK - LONGACRE 3-3227

PHONE NEW JERSEY - UNION 3-2600

COMPLETE DIESEL PLANT

3—Fairbanks Morse units. 805 HP—556 KW; 690 HP—473 KW; 300 HP—200 KW. Model 33-E-14. 3/60/2400 volts. New 1940. Will sell all or part. With auxiliaries. Condition excellent.

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TWO PRACTICALLY NEW WORTHINGTON CARBONDALE

REFRIGERATION COMPRESSORS

300 Ton Freon

Ideal for large plant or office building

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INDIANAPOLIS, INDIANA

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- Cut to length. Reasonably priced.

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Anything in **ELECTRICAL EQUIPMENT**

PARTIAL STOCK LIST — SEND US YOUR INQUIRIES

MOTOR GENERATOR SETS

150 KW W.H., Type Sk, 250 V, D.C., 2300/.3/60—1200 RPM, A.C. Sync.

150 KW Al.Ch., 230 V, D.C. 2300/3/60—1200 RPM, A.C. Sync.

ROTARY CONVERTERS

2—1000 KW, G.E., Type HCC, 600 V, D.C. with transformers, 900 RPM, 6 Phase, compound interpole.

SYNCHRONOUS MOTORS and CONDENSORS

2—W.H., 1500 KVA, 4600/2300/3/60—900 RPM, 2 Pedestal Bearing

1—G.E., 1500 KVA, 4600/2300/3/60—900 RPM, 2 Pedestal Bearing

1—400 HP W.H., Form 15, P.F. .8—P.B. 900 RPM

D.C. MOTORS

1—200 HP Reliance, 1050T, 850 RPM
3—7½ HP W.H., SK 190, 400/1600 RPM
3—15 HP W.H., SK 100L, 500/1500 RPM

D.C. GENERATORS

2—300 KW, W.H. 125 Volts—750 RPM
1—100 KW, W.H. 125 Volts—900 RPM

SLIP-RING MOTORS

1—Al. Ch. 400 HP, 505 RPM, 2300 V, Serial #110,844
1—Al. Ch. 400 HP, 1800 RPM, 2300 V, Serial #9410H146D

MOTORS, GEAR HEAD, A.C.

7½ HP W.H. TEFC, 3/60/220/440-580 RPM—RB
20 HP Link Belt, Size DM70, 3/60/220/440-74 RPM—RB
20 HP W.H. TEFC, 3/60/220/440-194 RPM—RB
40 HP G.E., TEFC, 3/60/220/440-561 RPM—RB

GEAR REDUCERS

1—Falk, Type 11HCP, 200 HP Ratio 10:1

BUCKEYE *Trading Corporation*

LARGEST STOCK IN MIDWEST

1019 PAPIN STREET CHESTNUT 2110 ST. LOUIS 2, MISSOURI

POWER EQUIPMENT

TURBINE UNITS

1—5000 KVA G.E. 3/60/2300/4000 V. 3600 RPM STRAIGHT CONDENSING nozzled for 450 psig 750° TT. Surface Condenser.

1—3750 KVA G.E. 3/60/2300/4000 V. 3600 RPM STRAIGHT CONDENSING nozzled for 200 psig 550° TT. Suface Condenser.

1—3750 KVA West. 3/60/2300/4000 V. 3600 RPM STRAIGHT CONDENSING nozzled 375 psig 575° TT, 11.75# water rate, surf. cond.

1—1250 KVA Al.Ch. 3/60/480 V. 3600 RPM, Terry EXTRACTION turbine nozzled 250 psig 550° TT, 40,000# extr. 25 psig, surf. cond.

BOILERS

1—75,000# Springfield sectional header cross drum 400# WP 750° TT.

1—50,000# Edgemoor bent tube 255# WP 490° TT Coxe chain grate stoker and economizer. New 1939.

2—502 HP Heine water leg type 200# WP 480° TT Coxe chain grate stokers. New 1929.

DIESEL & GAS ENGINE UNITS

1—2800 HP Nordberg 6900 V. 60 cy.
1—2000 HP Fairbanks Morse 6900 V. 60 cy.
1—1600 HP Fair. Morse 2300/4150 V. 60 cy.
1—275 HP Ing. Rand 240 V. 60 cy. (Gas)
1— 250 HP Buckeye 240 V. 60 cy.

MOTOR GENERATOR SETS—60 CY.

QU.	KW	MFR.	V.—DC	A.C.	RPM
1	3000	G. E.	250	13200	514
1	1500	G. E.	600	4150	600
2	1000	West.	660	4150	900
1	200	West.	275	2200	900
2	150	G. E.	250	2300	1200
1	75	Ridgway	125	220	1200

SYNCHRONOUS MOTORS

QU.	HP	MFR.	VOLTAGE	RPM
2	700	West.	2300	200
1	600	G. E.	2300	240
1	3000	G. E.	2300	600
1	300	West.	2300	900
4	125	G.E.	2300	720

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	12500	G.E.	25/60	300
2	6875	West.	25/62½	375
1	3750	G.E.	25/60	300
1	3125	G.E.	25/60	300
1	2500	G.E.	25/62½	750
1	1875	A.C.	60/25	300

OIL CIRCUIT BREAKERS—Outdoor

4— 800 A. 132 KV West. G-222A-2500
1— 400 A. 73 KV Condit FO-40-250
2— 400 A. 37 KV G.E. FHKO-136-350
4— 600 A. 15 KV G.E. FHKO-139-750
1—1200 A. 15 KV G.E. FKO-139-350

TRANSFORMERS

4— 3333 KVA West. 69300/66000—33000
4— 2500 KVA Mel. 69000—13800
6— 2000 KVA G.E. 66000/114000—2400
4— 500 KVA West. 69000—6900
3— 150 KVA Mel. 44000—2400/7200
3— 75 KVA West. 44000—7200/12470 Y
4— 5000 KVA G.E. 40935/70900 Y—14500
4— 333 KVA G.E. 33000—7200/12470 Y
3— 200 KVA A.C. 33000—2400/7200/12470
3— 150 KVA Wag. 33000—7200/12470 Y
3— 100 KVA West. 33000—240/480 NEW
3— 75 KVA Wag. 33000—7200/12470 Y
6— 2125 KVA G.E. 26400/13200—2300
4— 1500 KVA A.C. 25400/44000—6900/13800
4— 450 KVA A.C. 25410/44000—13280/23000
3— 1250 KVA G.E. 23000—2300/4000
3— 100 KVA G.E. 22000—7200/12470 Y
1— 3000 KVA Stand. 19050/33000—4160, 3 ph.
1— 5000 KVA Pitts. 13200—4600, 3 ph.
1— 450 KVA Penn. 13200—2400, 3 ph.
3— 250 KVA West. 13200—240/480
3— 200 KVA G.E. 11800—2300
3— 250 KVA Pitts. 7200—220/440
3— 100 KVA G.E. 7200—240/480
3— 150 KVA Wag. 6900—2300
3— 37½ KVA G.E. 6900—230/460
4— 150 KVA G.E. 4800/2400—240/120
2— 250 KVA West. 2300—460
3— 250 KVA G.E. 2300/4000 Y-115/230
3— 150 KVA West. 2400—230/115
1— 100 KVA G.E. 2300—575, 3 ph.
6— 50 KVA West. 2400—114/228 DRY TYPE

PARTIAL LIST ONLY

BREW, WOLTMAN & CO., INC.
50 Church St. New York 7, N. Y.

SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	Make	Type	Speed	Description
400	G.E.	I-M	1200	S.B.
300	G.E.	I-M	1200	S.B.
200	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1800	S.B.
100	G.E.	MT-300	1800	S.B.
100	G.E.	I-M	900	S.B.
100	G.E.	I-M	720	S.B.
75	G.E.	MT-343	1200	S.B.
75	G.E.	I-M	900	S.B.
75	West.	CW	720	S.B.
75	G.E.	I-M	720	S.B.
60	G.E.	MT-333	1800	S.B.
40	G.E.	I-M	1800	S.B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	Make	Type	Speed	Description
150	G.E.	K-6326	3600	TEFCBB
150	G.E.	K-6326	1800	TEFCBB
125	G.E.	K-6326	1200	TEFCBB
100	West.	CS-6075	1800	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ARZ	1800	TEFCBBused
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-445	1800	B. B. open
75	F.M.	QS-445	1800	B. B. open
75	West.	CS-505	1200	TEFCBBXP
60	West.	K-5945	1800	TEFCBBXP
60	G.E.	OG-44	1800	TEFCBBXP
60	L.A.	QS-444	1800	B. B. open
60	F.M.	FB-404	3600	B. B. open
50	Master	K-445	1800	TEFCBBXP
50	G.E.	K-405	1800	TEFCBB
50	G.E.	CS-445	1200	S. B. drip
50	West.	K-505	900	S. B. open
50	G.E.	AR-444	3600	TEFCBBXP
40	A.C.	KF-365S	3600	TEFCBBXP
40	G.E.	CS-405	1800	B. B. Splash
40	West.	K-405	1800	TEFCBB
40	L.A.	404	1800	TEFCBBXP
40	G.E.	CS-504S	1800	B. B. open

REBUILT SQUIRREL CAGE MOTORS

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	Make	Type	Speed	Description
200	Wagner	RP-2-26	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-564	900	B. B. new
150	West.	CS	1800	S. B.
150	G.E.	I-K	1200	S. B.
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	MS	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S. B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S. B.
75	West.	CS-WL-607	1200	S. B. B.
75	G.E.	KT-552	900	S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-346	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-346	900	S. B.
60	G.E.	I-K	908	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.

We have in stock explosive proof motors 220/440/60/3 ranging in HP from ½ to 50 HP 900 to 1800 RPM. We also carry in stock a large quantity of used electric motors from 1 HP up to 500 HP., generators, transformers and control equipment. Upon receipt of your inquiries, we shall be glad to quote.

POWER
EQUIPMENT COMPANY
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P. O. BOX 534 — Tel: Genesee 5629

FOR SALE

(6) OIL FIRED B&W BOILERS

Cross Drum Sinuous Headed straight tube type. Heating surface 11417 sq. ft.—1141.7 HP—210 P.S.I.G. design pressure—200 P.S.I.G. working pressure—75,000 lbs./hr. capacity—steam temp., saturated—1024 cu. ft. furnace volume —200° feed water temperature.

(2) B&W WATER TUBE BOILERS

ASME code—from ATR tug—built 1943. 15,000 lbs. steam/hr./unit (normal) 18,000 lbs. steam/hr/unit max. Design pressure—268 lbs/sq. in. —total steam at drum outlet (saturated) 409 —forced draft—turbine driven blowers—1508 sq. ft. boiler heating surface. Gas or oil.

(4) 300 KW G.M. 8-268A DIESEL GEN.

G.M. diesel generator sets—120/240 volts DC —1200 RPM—1250 amps.—8 cyl. 6½x7—with switchgear.

(1) 30 KW G.M. 3-71 DIESEL GEN.

GM 4½x5 2 cyl. diesel—radiator cooled—electric starting. Delco 440/3/60 generator—with switchgear. Skid mounted—portable.

(2) 100 KW GM 3-268A 440/60/3 AC generator sets.

(1) 100 KW LORIMER 440/60/3 AC generator set.

(1) 100 KW FAIRBANKS-MORSE opposed 440/60/3 AC generator set.

(6) 300 KW TURBO GENERATOR SETS

120/240 volts DC—Joshua-Hendy turbine—250 lb. W.P. condensing. Suitable for pressures to 440 lbs. at 740°TT. Geared to 1200 RPM. 300 KW Westinghouse 120/240 volt 1250 amp. stablized shunt generator. With switchgear. Built 1945. Excellent condition.

(1) SUPERIOR HEAVY DUTY DIESEL

510 HP at 360 RPM—5 cylinder—14½x8—type ZDSB—non-reversing—vertical—4 cycle—cold starting—mechanical injection. Engine totally enclosed. For heavy duty pumping, dredge service, power generation, textile & saw mills, etc. Excellent condition. Immediate delivery.

ELECTRIC WINCHES

50 HP—230 volts DC—built in controls—5 ton and 10 ton.

THE BOSTON METALS CO.
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Curtis 7-5050

FLUID DRIVE · GYROL TYPE VS
HYDRAULIC COUPLINGS

Stepless speed variation with constant speed prime mover made by American Blower Co. Ideal for pumping stations, steel mill drives, mechanical draft fans, crushers, rotary kilns, etc.

Wide range of capacities—Condition 90% new
200 HP to 2500 HP Input
300 RPM to 900 RPM Input
Complete data & quotation on request.

Also large selection of marine couplings, reduction gears, & Falk grid type couplings in stock.

A.G. SCHOONMAKER CO., INC.
50 Church St., New York 7, N. Y.

50,000 & 20,000 Gal. Water Tanks-Towers
500 & 750 KW Non-Cond. Turbo Gen. Sets
300 HP 200# P. Package Type Boiler—3 yrs.
70' x 26" Wide Belt Conveyors (2)
200 KW Diesel Elec. Set on skids
24x20 Jeffrey Dbl. Roll Crusher
Joy 7 BU Loading Machines—AC
60 HP GE Slip Ring Hoist Motor
H. & P. 6719 Etzel, St. Louis 14, Mo.

POWER PLANT MACHINERY

TURBINE GENERATOR UNITS
3 Phase 60 Cycle

32,500 KVA G.E. Cond. 250 lbs. 12000/13200 volts.
12,500 KVA West. Cond. 200 lbs. 2400 volts.
5,000 KVA G.E. Non-cond. Extraction 600 lbs.-125 lbs. extr. 50 lbs. exh. 13,800 volts.
5,000 KVA West. Cond. Extraction 400 lbs.-125 lbs. extr. 2400 volts.
3,750 KVA West. Cond. Extraction 175 lbs.-25 lbs. extr. 240 Ovolts.
3,125 KVA West. Cond. 400 lbs. 2400/4160 volts.
2,500 KVA West. Cond. 200/400 lbs. 2400 volts.
1,875 KVA G.E. Cond. 225 lbs. 480 volts.
1,563 KVA G.E. Cond. 150 lbs.-15 lbs. extr. 480 volts.
1,250 KVA West. Non-cond. 150 lbs.-30 lbs. exh. 480 volts.
1,250 KVA West. Cond. Extraction 250 lbs.-125 lbs. extr. 480 volts.
1,175 KVA A.C. Cond. Extraction 300 lbs.-30 lbs. extr. 240 volts.
938 KVA G.E. Non-cond. 150 lbs.-20 lbs. exh. 480 volts.
938 KVA West.-Terry Cond. Extraction 250 lbs.-45 lbs. extr. 480 volts.
625 KVA G.E. Non-cond. 175 lbs.-30 lbs. exh. 2300 volts.
187 KVA West. Non-cond. 150 lbs.-15 lbs. exh. 480 volts.

UNIFLOW GENERATOR UNITS
3 Phase 60 Cycle

750 KVA Ames vertical, 150-175 lbs. 240/480/2300/4160 volts.
500 KVA Skinner horizontal, 150 lbs. 240 volts.
375 KVA (2) Skinner horizontal, 150 lbs. 240/480 volts.
312 KVA Skinner horizontal, 150 lbs. 240 volts.
250 KVA Ames vertical, 150 lbs. 480 volts.
210 KVA Skinner horizontal, 150 lbs. 240 volts.
156 KVA Skinner horizontal, 150 lbs. 240 volts.

DIESEL GENERATOR UNITS
3 Phase 60 Cycle

1,250 KVA Nordberg, 2400 volts 257 RPM.
1,000 KVA DeLaVergne, 2400 volts 200 RPM.
856 KVA DeLaVergne, 2400 volts 240 RPM.
650 KVA Superior, 2400 volts 327 RPM.
625 KVA Cooper-Bessemer, 480 volts 600 RPM.
500 KVA (2) Fairbanks Morse, 2400 volts 400 RPM.
450 KVA (3) Alco, 480 volts 514 RPM.
425 KVA Fairbanks Morse, 2400 volts, 400 RPM.
400 KVA (3) General Motors, 480 volts 1200 RPM.
375 KVA (3) Worthington, 2400 volts, 327 RPM.
375 KVA General Motors, 480 volts, 1200 RPM.
312 KVA Superior, 480 volts, 360 RPM.
300 KVA Fairbanks Morse, 2400 volts, 300 RPM.
250 KVA Worthington, 240 volts, 327 RPM.
150 KVA Fairbanks Morse, 240 volts, 360 RPM.
150 KVA Worthington, 240 volts, 600 RPM.
125 KVA Hercules, 440/220/127 volts, 1800 RPM.
112 KVA (2) Cooper-Bessemer, 2400 volts, 450 RPM.
94 KVA (2) Chicago Pneumatic, 240/480 volts, 720 RPM.
75 KVA Winton (gasoline) 240/480/2400 volts 1200 RPM.
62½ KVA International Harvester, 240 volts, 1200 RPM.
37½ KVA General Motors, 240 volts, 1200 RPM.

STEAM BOILERS

150,000 lbs. per hr. (3) B.&W., 250 lbs. stoker coal
100,000 lbs. per hr. B.&W., 450 lbs., stoker coal
50,000 lbs. per hr. B.&W., 450 lbs. pulv. coal.
35,000 lbs. per hr. (2) B.&W., 400 lbs., coal or gas.
22,500 lbs. per hr. Keeler, 300 lbs., stoker coal.
20,000 lbs. per hr. B.&W., 125 lbs., stoker coal.

MOTOR GENERATOR SETS
3 Phase 60 Cycle

3,000 KW G.E. 13200 volts AC—250 volts DC.
2,000 KW A.C. 2300 volts AC—250 volts DC.
1,500 KW G.E. 2300/4000 volts AC—250 volts DC.
500 KW (2) West. 2300/4160 volts AC—250 volts DC.
300 KW G.E. 2300 volts AC—250 volts DC.
200 KW (3) West. 2300/4000 volts AC—250 volts DC.
150 KW G.E. 2300/4000 volts AC—250 volts DC.
100 KW West. 2300 volts AC—250 volts DC.

ROTARY CONVERTERS
3 Phase 60 Cycle

3,250 KW G.E. 13800 volts AC—250 volts DC.
1,500 KW (2) West. 13200 volts AC—250 volts DC.
300 KW A.C. 13200 volts AC—250 volts DC.
150 KW (3) West. 6600 volts AC—250 volts DC.

TRANSFORMERS
60 Cycle

10,000 KVA (1) A.C. 3 ph., 12000-2400/4160 volts.
6,300 KVA (1) West. 3 ph., 66000-6600 volts.
6,000 KVA (1) Pgh. 3 ph., 11000-2300 volts.
5,000 KVA (1) A.C. 3 ph., 12000-2400/4160 volts.
3,000 KVA (1) Stand. 3 ph., 33000-4160 volts.
2,125 KVA (3) G.E. 1 ph., 13200-2300/4000 volts.
2,000 KVA (5) West. 1 ph., 38000-12000 volts.
800 KVA (3) Wgnr. 3 ph., 2400/4160-480 volts.
500 KVA (3) Pakd. 1 ph., 13200-1100/220 volts.
500 KVA (4) G.E. 1 ph., 33000-7200/12470 volts.
500 KVA (1) G.E. 3 ph., 2300-600 volts.
333 KVA (3) G.E. 1 ph., 33000-2300 volts.
300 KVA (2) G.E. 3 ph., 69000-2300/4160 volts.
250 KVA (3) G.E. 1 ph., 2300-150/230 volts.
200 KVA (3) Nga. (New) 1 ph., 2400/4160-240/480 volts.
100 KVA (5) G.E. 1 ph. 4000-115/230 volts.
25 KVA (3) G.E. 1 ph. 2300-230/460 volts.

Write, Wire or Phone For Further Details and Prices.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 1-9514 **CLEVELAND 14, OHIO**

TAMPA ★ TAW ★ ARMATURE WORKS

"Industry's Friend"

TURBO-GENERATORS

CONDENSING

1—6250 KVA 5000 KW 3600 RPM Allis Chalmers 200 lbs. 100° SH. Will operate 275 lbs. 6150 TT without change. Generator 3/60/11500. Can be changed to 2400/4160. Complete auxiliaries. Can be operated for inspection. Checked by factory engineer in Sept. 1951—no repairs required.
1—1567 KVA 1250 kw 3600 RPM Allis-Chalmers 150 lbs. Will operate 200 lbs. 450° TT without change. Generator 3/60/2300. Complete auxiliaries.
1—1250 KVA 1000 kw 3600 RPM Westinghouse 185 lbs. 100° SH 3/60/2300. Completely reworked, generator has new winding. Complete auxiliaries.
1—937 KVA 750 kw 3600 RPM Gen. Elec. 150 lbs. Generator 3/60/2300.

NON-CONDENSING

1—1250 KVA 1000 KW 3600 rpm General Electric 140 lbs. turbine with type ATB Form T 3/60/2300, 80 pf, Synchronous Generator.
1—625 KVA 500 kw 3600 rpm General Electric 175 lbs. Single stage turbine with type ATB form T 3/60/2300, 8 pt. Synchronous Generator.
1—187½ KVA 150 kw Westinghouse geared 7200/900 rpm 150 lbs. 100° SH. Generator 3/60/240.
1—125 KVA 100 kw Westinghouse geared 7200/900 rpm 150 lbs. 3/60/240.

We will rewind these generators to your specifications

10,000 KVA TRANSFORMER
BANK OF 3-3333 1 Ph. 60 Cy.
66000 to 33000 & 13200 VOLTS

1800 KVA 3 Ph. TRANSFORMER
6600 to 440 VOLTS 60 Cy.
READY TO SHIP

TRANSFORMERS 1 PH. 60 CY.

2—1000 KVA 13200-2300 v. 1 ph. 60 cy. Gen. Elec.
4—200 KVA 33000-2300/4600 v. 1 ph. 60 cy. Pittsburg
10—100 KVA 33000-2300/4600 v. 1 ph. 60 cy. Pittsburg
3—100 KVA 33000-2300/4600 v. 1 ph. 60 cy. Allis-Ch.
Large stock 2400/4160 Y.—120/240 v. 1 ph. 60 cy. Distribution Transformers

10—25 KVA
13—15 KVA
63—10 KVA
61—7½ KVA
65—5 KVA
20—3 KVA
13—1½ KVA

OUTDOOR INSTRUMENT TRANSFORMERS

13—33000/110 V. 200 V.—A GE E116 Potential
3—33000/110 V. Westinghouse Potential
2—60-120/5A 37KV GE—K61 Current

1—2500 KVA Forced air, 11500-480 v. 3 phase, 60 cycle General Electric Pyranel indoor

OIL CIRCUIT BREAKERS—Outdoor

1—600 A. 110 KV GE FKO136
1—400 A. 73 KV West. G—1
2—400 A. 37 KV GE FKO136
1—400 A. 37 KV WEST. 0221
1—1200 A. 15 KV GE FHKO236

OIL CIRCUIT BREAKERS—Indoor

1—2000 A. 15 KV 500 MKVA West. CO-11
9—1200 A. 15 KV 500 MKVA West. CO-11
1—800 A. 15 KV 130 MKVA West. B-20
12—400 A. 15 KV 130 MKVA West. B-20
1—2000 A. 4500 V. GE K-34

TAMPA ARMATURE WORKS INC.

401 S.MORGAN ST. TAMPA, FLORIDA PHONE 2-1966

FOR IMMEDIATE SALE
2—4000 K.W. TURBINE GENERATING PLANT

TURBINES: C. A. Parsons Ltd., Single cylinder reaction, high pressure type condensing, 55 stages, 150 p.s.i. gauge, 200° F superheat, 3600 RPM. Governed to 10% overspeed and regulated no load to full load. Direct connected to:

ALTERNATORS: 4000 K.W., 5000 K.V.A., 2300 Volts, 60 Cycles, 3 Phase, 3600 R.P.M., with direct driven:

EXCITERS: 29 K.W., 125 Volts, 3600 RPM.

CONDENSERS: Worthington-Simpson high Vacuum low level jet type with extraction pump.

AUXILIARIES: Complete set of auxiliaries, including switchboards, circuit breakers, current and potential transformers, Bailey steam flow meters, water cooling towers and pumps, pipe and fittings, etc.

CONDITION: Purchased 1934—Used less than eighteen months—well maintained.

Inspection welcomed

N. SMITH BELTING WORKS, LTD.
138 York St. Toronto, Canada

STORAGE & PRESSURE TANKS
Located Mich.-Mo.-Fla., N.J. & Conn.

8—12,000-17,000 & 20,000 Gal. 90 Lb.
16—10,000-15,000 & 20,000 Gal. Storage
9—42,000, 120,000 & 240,000 Gal. Storage
10—10,000 Gal. Cap. RR Car Tanks

LESTAN CORP., ROSEMONT, PA.

MOTORS · MG SETS

Qty.	HP	Make	Voltage	Speed
12	3000	West.	525/600	600 RPM
26	1500	West.	525/600	600 RPM
32	1500	Al. Ch.	525/600	675 RPM
4	1200	Al. Ch.	525/600	650 RPM
2	900	Elliott	230	300/195 RPM
3	800	West.	525/600/900/900	RPM
1	650	Cr. Wh.	230	475/720 RPM
1	500	West.	230	250/500 RPM
1	400	G.E.	230	180/360 RPM
7	400	Elliott (new)	230	400/800 RPM
5	400	West. (new)	230	375/750 RPM
2	350	Cr. Wh.	230	400/800 RPM
1	200	Cr. Wh.	230	500/750 RPM
1	200	Cr. Wh.	230	375/750 RPM

All motors designed for mill reversing service.
Smaller sizes also in stock.

Motor Generator Sets in Stock
100—2000 KW Capacity

All of above is modern late type equipment remanufactured & tested by our engineers.

Write, Wire, Phone

All guaranteed for one year

A. G. SCHOONMAKER CO., INC.
50 CHURCH STREET, NEW YORK 7, N. Y.
Plants: SAUSALITO (S.F.) CAL., JERSEY CITY, N.J.

BOILER FEED PUMPS

1—Lecourtenay 675 G.P.M., Type 4M 8B, 5 stage, 1100 Ft. Hd.
1—Worth. 740 G.P.M., type WCS-2, 5", 2250 Ft. Hd.
1—Worth. 700 G.P.M., type UNS-1, 6 stage, 6". 1550 Ft. Hd.
2—I. R. 200 G.P.M., 2", 1375 Ft. Hd.

Pumps above are mounted on basis for motor or turbine drive.
We have about 200 various size cent. pumps on hand, turbine, motor, and gasoline driven. Send us your inq.

DALTON SUPPLY CO.
2829 Cedar St. Phila. 34, Pa.

FOR SALE
18 NEW TURBINES

4 horizontal, 14 vertical, Westinghouse

Driving forced draft blowers—capacities ranging from 39000 to 56000 CFM and 16" to 24" pressure. Steam pressures 360 to 575#, back pressure 10#.

Will sell turbines separately if desired. *Price reasonable.*

Also—1—250 KW GE turbo generator unit, 3 phase, 60 cycle, 440 volt. Used one year.

G. M. DeROSE
2457 WOODWARD AVE.
408 DONOVAN BLDG.
DETROIT 1, MICH.

POWER EQUIPMENT

Boilers—Turbines—Engine—Generators—Diesels. Furnishers & Erectors

Write for Latest Listing

BENJAMIN W. BISSELL
610 K of P Building; Indianapolis 4, Ind.
Phone Lincoln 4007

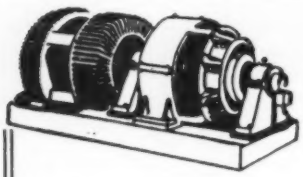
FOR SALE

2—Size 4 Riley Atrita Unit Pulverizer with separately driven coal feeders.

1—Hoppes Feedwater Heater, Class H, Size D Rated at 4000 boiler HP.

1—Cameron Boiler Feed Pump—4 stage, 500 gpm. 462 ft. head, 1750 RPM. All removed in plant expansion program. Spare parts included, priced to sell.

NEKOOSA-EDWARDS PAPER CO.
PORT EDWARDS, WISCONSIN



SEARCHLIGHT EQUIPMENT SPOTTING SERVICE

This service is aimed at helping you, the reader of POWER, locate used and surplus new power equipment not currently advertised (this service is for user-buyers only).

Just send in the specifications of the equipment wanted on the coupon below, or on your own company letterhead.
Your requirements will be brought promptly to the attention of the used equipment dealers advertising in this issue. You will receive replies directly from them.

NO CHARGE • NO OBLIGATION

Searchlight Equipment Spotting Service c/o POWER
330 W. 42nd St., New York 36, N. Y.

Please help us locate the following used equipment:

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NAME ..... TITLE .....

COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

7-53

TRANSFORMERS

Quan.	Mfr.	KVA Rat.	Volt.
3	Westinghouse	833 ea.	13800-480
3	Davis	677 ea.	6600-4000
4	Packard	500 ea.	13200-110/220 2300/4000-115/230
2	G.E.	400 ea.	
3	Westinghouse	200 ea.	13800-120/240
5	Westinghouse	100 ea.	4600-115/230

Brand New Special Offer

15	Central Trans. Co. (air, dry)	15 ea.	240/480-120/240

KAPLAN METALS CO.
PHILADELPHIA 34, PA.
NEBRASKA 4-1210

USED 35 TON BRIDGE CRANE

75' span with 5 ton aux, 25' lift. Cab type 3/60/220 V. A.C.—used approx. 2 yrs. Mfg. Northern—*excellent condition.*

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2411 35th St. Tampa, Fla.
P.O. Box 5033 Ph. 4-2367

FOR SALE
ONE BIGELOW 50 H. P. BOILER

2-pass, Petro oil burner, controls, pump, valves, etc., fully automatic.

KENYON'S CLEANING CO.
Westerly, Rhode Island

GENERATOR SET BARGAIN

187½ KVA alternating current generator, 3 phase, 60 cycle, 440 volt, with belted 15 KW, 125 volt exciter. Direct connected to a Skinner Universal Uniflow engine 150# steam pressure, 5# back pressure. Operating panel includes AC & DC volt meters, ammeters, rheostats, circuit breakers, GE voltage regulator. Piping, valves etc. Unit may be inspected in operation. A rare bargain. Write Mr. W. HILL, HILLWOOD MFG. CO., 21700 St. Clair Ave., Cleveland, Ohio.

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
600	2200	Whse.	450
540	2300/4000	G.E.	900
450	440	Whse.	514
300	440	G.E. (hoist)	600
300	2300/440	Whse. (new)	600
300	2200	G.E.	360
300	440	Whse.	3600
250	4000/2300	G.E.	450
250	440/220	Whse.	600
250	550/440	G.E.	1200
250	440	G.E.	600
200	440/220	Whse.	514
200	440	G.E.	450
188	4000/2300	G.E.	1800
150	2200/440	G.E.	600
150	550/220	G.E.	720
145	4000/2300	G.E.	1800
135	440/220	G.E. (hoist)	600
125	440/220	G.E.	900
125	550/440	G.E.	1200
125	2200	G.E.	600

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	2200/440	G.E.	ATI	720
300	2300/400	G.E.	TS	720
300	2300/440	G.E.	TS	720
250	440/220	Whse.	HR	277
250	2200/440	G.E.	TS	1200
250	440/220	G.E.	ATI	600
240	2300/440	G E	ATI	720
225	440/220	Whse.	HR	360
200	4150/2300	Whse.	G	1800
125	440/220	Whse.	HR	600
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	G.E. (25 cy.)	TS	375
75	2200/440	Whse	GE	600

CIRCUIT BREAKERS

2—2000 amp., GG E., 3 pole, 600 v
2—1600 amp. ITE, 3 pole, 600 v

200 KW GE RECTIFIER UNIT

1—new—Ignitron type, 250/275 V. DC, 4000/2300 V. AC, 3 ph., complete all accessories including transformer, switch gear, etc.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
600	2200	G.E.	FT	3600
500	2200/4000	Elliot	SC	1800
350	2200	G.E.	KT	1200
350	2300	G.E.	KT	1200
300	2200	L. Allis	FS	1800
300	2200	G.E.	FT	3600
250	2200/440	G.E.	IK	720
225 (2)	2200/440	G.E.	KT	1200
200	2200/440	G.E.	K	1200
200	440	G.E.	IK	720
200	440	G.E.	IK	514
200	440/220	G.E.	KT	1800
200	2200/440	G.E.	IK	600
150	2200	Al. Chal.	AR	1800
150	220	Whse.	CS	1200
150	440	Multi sp.	KT	1800/600
150	440/220	G.E.	IK	450
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150	440/2200	G.E.	IK	514
150	2200/440	G.E.	KT	600
125	440/220	G.E.	KT(vert.)	1200
100	2200/440	G.E.	K	1200

A. C. GENERATORS

1—320 kva, 660 rpm, 2300/440/220 V., G.E.
1—275 kva, 1200 rpm, 440 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—200 kva, 720 rpm, 2200/440 V., G.E. (Ball brg.)
1—187 kva, 1200 rpm, 2200/440 V Whse

D. C. MOTORS

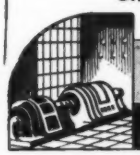
HP	Volts	Make	Type	Speed
250	230 (2 new)	Cr. Wh.	CMC	1800
150	230	G.E.	CD	1750
150	230	Whse.	SK	850
120	230	Whse.	SK	350/1050
100	230	El. Dyn.	30-3	475/1250
100	230	Cr. Wh.	CMC	625
90	230	G.E.	CD	1750
80	230	G.E.	BC	600
50	230	Rel.	T	600/1200

MOTOR GENERATOR SETS

KW	Make	Input V., AC	Motor Type	Output V., DC
250	Whse.	2200	Syn.	250
175	G.E.	220/440	Syn.	250
150	Whse.	440	sq. ca.	250
100	Al. Ch.	2200/440	sq. ca.	240/120
100	Whse.	440/220	sq. ca.	125
75	G.E.	2200/440	syn.	125
65	G.E.	2200/440	sq-ca.	250
65	G.E.	2200/440	sq.ca.	125
60	G.E.	440/220	sq.ca.	250/125
45	G.E.	440/220	sq.ca.	250
40	G.E.	440/220	sq.ca.	250/125

TRANSFORMERS 60 CY.

3— 500 kva, Whse., 24000—2300 V.
1— 300 kva, Al. Chal. 4800/4160—240/120 V., 3 phase
3— 200 kva, G.E., 11000—2300 V.
3— 200 kva, G.E., 4150—480/240 V.
3— 150 kva, G.E., 33000—2300/4000 V
3— 150 kva, Al. Chal., 2400—240/480 V.
3— 100 kva, Whse., 2400-240/480 V.
6— 100 kva, Whse., 2400—120/240 V.
5— 100 kva, G.E., 4150—120/240 V.
2— 100 kva, Whse., 2400—120/55 V
3— 75 kva, Whse., 2400—240/480 V
3— 75 kva, Moloney, 4150—240 V
3— 50 kva, Whse., 440—220/110 V., dry
6— 50 kva, G.E., 2400-120/240 V
11—50 kva, Whse., 2300-110/220 V., dry



STEPHEN HALL & CO.

HARRY J. RICE PRES

458 SEVENTH ST. HOBOKEN, N. J.

TURBINE GENERATOR SETS

1—125 KVA GE AC/3/60/220 Volts/1200 RPM
1—250 KVA Elliott AC/3/60/220 Volts/1200 RPM
4—250 KVA GE AC 3/60/440 Volts/1200 RPM
4—500 KW West. DC/120-240 Volts 1200 RPM

DIESEL ENGINES & GENERATING SETS

20—G.M. Quads (Navy Re-processed)
2—Hamilton 1600 HP 720 RPM w/Dir. Con. Blowers
3—GM 3-268A w/100 KW West. AC/440V/1200 (WILL SELL PARTS & GENS. SEP.)
1—G.M. 2-268A 500 HP Marine Propulsion Engine w/rev. reduction gear & access.
1—Cooper-Bessemer FS8 500 HP 900 RPM
* 2—Hercules DWXD w/Heat Ex. & Clutch
* 1—Werth. DD8 w/500 KW GE 3/60/2300V/375
* 2—GM 8-268A w/200 KW West. 3/60/440V/1200

SYNCHRONOUS MOTORS

** 4— 75 HP Burke 3/60/220-440V/1800
** 2—125 HP El. Mach. 3/60/4800V/900
15—135 HP GE 3/60/4000 V/1200 TS863Z
* ** 1—200 HP El. Mach. 3/60/208V/1200
* 1—350 HP El. Mach. 3/60/208V/1200

AC & DC GENERATORS

* ** 75—3 KW GE 3/60/120-208V/1800 w/Panels
* ** 50—10 KW GE 3/60/120-208V/1800 w/Panels
* ** 8—25 KVA GE 3/60/440V/1800
** 2—56 KVA Star 3/60/120-208V/1200
1—75 KVA El. Mach. 3/60/440V/900
2—500 KVA El. Mach. 3/60/440V/900
** 4—25 KW West. DC 125V/1800 2 Brg.
4—500 KW West. DC 120-240V/1200
*NEW—**BALL BEARING

ALBERT HELLER CO.
210 Snediker Ave., B'klyn 7, N.Y. HYacinth 5-0800

2—325 HP FAIRBANKS-MORSE

Model 31A8½; 514 RPM; diesel engines bare; 4 yrs. old. Low price will astound you!

Send for stock list.

MIDWEST UTILITIES POWER EQUIPMENT CORP.
1270 Augusta Boulevard, Chicago 22, Ill.
Phone: EVergiade 4-4511

2—75 KW, GENERAL ELECTRIC 3 WIRE M.G. SETS

GENERATOR: 75 KW, type CD 1242, 250/125 volts, 1200 RPM, Compound Wound.

MOTOR: 125 HP, type K-5362, 3 phase, 60 cycles, 220/440 volts, 1200 RPM, Squirrel Cage.

Complete with DC Panels & AC (220 volts) Reduced Voltage Automatic Starters.

EMPIRE ELECTRIC CO., INC.
87 Jay St. BROOKLYN 1, N. Y.

NOW LIQUIDATING

AT MARION, INDIANA

1—Carbondale 10x10 Vert. twin cylinder Ammonia Compressor, 82 ton, 75 HP motor.

1—Taber Fermentation Gas Collector with 8 storage tanks 50 cu. ft., ASME 245# WP.

3—Niagara Spray Cooler and Fan Cooler Units.

1—Rotary Pump 5", with 40 HP motor, 1000 GPM—86' Hd.

12—Welded Steel Storage Tanks (closed) 10,500 gal., 11,300 gal. and 12,700 gal.

FOR SALE FROM PHILA. STOCK

2—I-R Motorblowers, type FS-538; cap. 4000 CFM @ 3# Pr.

1—Byron Jackson Bronze Deep Well Turbine Pump with 20 HP motor. 150 GPM.

1—I-R #1½-RVH Bronze Centrifugal Motor-pump with 20 HP motor. 200 GPM—200'.

PERRY EQUIPMENT CORP.
1422 N. 6th St. PHILA. 22, PA.

3—45,000# hr. Surplus Boilers

B & W Two Drum Bent Tube with Water Walls, 275# pressure 550° FTT & SH. new 1936-7.

In splendid condition

Other Boilers 150-450# pressure

Turbo Generators, Transformers

STEPHEN A. DOUGLASS CO.
630 Ft. Washington Ave., N. Y. 33, N. Y.

STEAM POWER PLANT

5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, Sturtevant Induced Draft Fans, Smoke Stacks. Good for 250# pressure by Hartford.
1—705 HP Stirling 4 drum Boiler with B&W Superheater, Green Chain Grate Stoker, Sturtevant Economizers, Sturtevant Induced Draft Fan, with Smoke Stack. Good for 250# pressure by Hartford.
2—5000 HP Webster Water Heaters.
1—McCaslin Pivoted Bucket Conveyor System for handling coal and ashes. Approximately 300' long.
6—Steel Coal Bunkers, 80 tons each.
1—30" Wheeler Single Stage Circulating Pump, 30,000 GPM direct connected to 300 HP Allis-Chalmers Motor, 3/25/440, 360 RPM. (Has extra impeller for 15,000 GPM)
1—4"x6" Dayton-Dowd Centrifugal Pump direct connected to 125 HP General Electric-Curtis Steam turbine.
1—100 KW General Electric 125 Volt DC Generator direct connected to a General Electric-Curtis Steam Turbine, 2-stage with reduction gear, Type SO. 3000 to 1200 RPM.
1—Type 1A-60 Wheeler Turbo Air Pump direct connected to 75 HP General Electric-Curtis 2-Stage Steam Turbine, 1750 RPM.
1—6" Wheeler Centrifugal Condensate Pump direct connected to a 20 HP General Electric-Curtis 2-Stage Steam Turbine, 1800 RPM.
1—Combination Circulating Pump and Condensate Pump driven by 190 HP General Electric single Stage Steam Turbine through a Westinghouse Reduction Gear, 3500 to 700 RPM.
1—2" 2-stage LeCourtney Centrifugal Pump, 200 GPM 650' Heat at 3700 RPM direct connected to 53 HP Westinghouse Steam Turbine.
1—3000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 250 RPM, 600 Volts DC with 1—3150 KVA General Electric Transformer, 3 phase, 25 cycle, 6600/13200-445 Volts with starting panel and all instruments.
1—1000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 750 RPM 600 Volts DC with 1-1050 KVA General Electric Transformer, 3 phase, 25 cycle, 13200/445 volts with starting panel and instruments.
1—500 KW Westinghouse Synchronous Converter, 6 phase, 60 cycle, 1200 RPM, 600 Volts DC with starting panel and instruments.
1—4000 KVA Westinghouse Transformer, 3 phase, 25 cycle, 13200/6600 volts.
7—700 KVA Westinghouse Transformers, single phase, 25 cycle, 7620/6600 volts to 13200 volts.
1—Kennecott Pressure Type Industrial Water Filter.
1—50-Ton Electric Traveling Crane—55'5½" Span.

Send for Complete Inventory

MORSE BROS. MACHINERY COMPANY
2900 BRIGHTON BLVD.
P.O. Box 1708, DENVER, COLORADO

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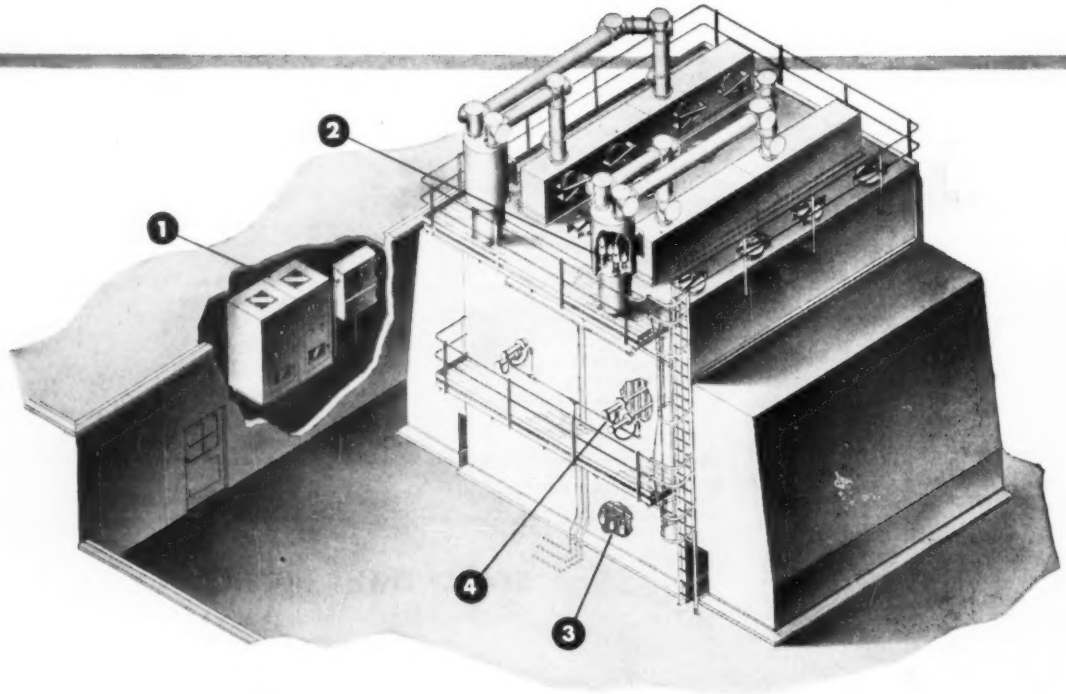

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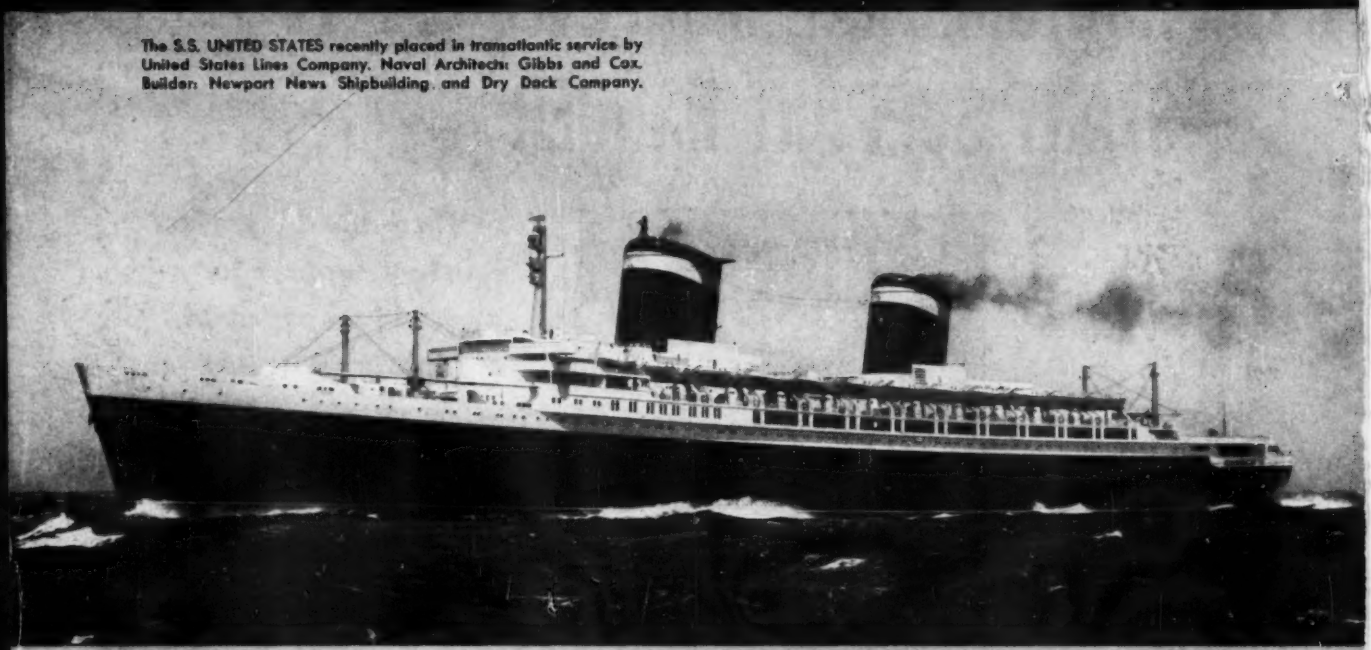

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